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SCIENCE AND THE ARTS.

Art. I. *An Inquiry into the Varieties of Sensation, resulting from difference of Texture in the sentient Organ.* *By* J. R. Park, *M. B. F. L. S.*

The nature and cause of sensation have been previously considered, and its phenomena traced up to the joint influence of physical and vital laws.

The circumstances have also been examined which seem to determine the degree in which this faculty is enjoyed by different parts, and by the same part, at different times.

Its general cause being established, we are now prepared to enter upon the examination of its several varieties as they appear connected with peculiarity of texture in the sentient organ.

This inquiry is calculated not only to enlarge the sphere of our knowledge as a speculative question, but may prove of practical utility. The uneasy feelings described by patients, afford to the medical practitioner a clue for discovering the seat of internal diseases, and he has often no better guide to direct him in ascertaining the nature of the derangement.

Sensation considered in general is the perception of changes going on in the body; and similar changes can only take place in parts similarly organized.

It is accordingly found that every part of the body which differs from another in structure, has also a different mode of sensation: and, were the kind of feeling peculiar to each

ascertained with certainty, greater facility would thereby be afforded in determining upon the organ affected; while additional insight would be gained into the nature of the affection by any light thrown upon the nature of the changes from which these feelings proceed.

The little success that has attended the researches hitherto made in this branch of physiological science, attests the difficulty of the subject, and claims some indulgence, for the imperfect manner in which it must still be treated.

Amongst the writers of our own country the question has been considered too generally to lead to results practically useful. The ingenious attempt of Dr. Hartley, to prove that all our sensations are immediately produced by vibrations between the particles composing the nervous fibres, is open to this objection. The doctrine maintained by Reid, that our sensations bear no affinity or resemblance to the physical causes which call them forth, is in fact, only a part of Hartley's proposition, implied in it, and clearly intended to be proved along with it; consequently it has no claim to originality; besides that his treatise is entirely metaphysical, and not physiological. Darwin's view, that sensations consist in, or rather proceed from, fibrous contractions of the nerves, appears to be only a modification of Hartley's, supported by similar arguments; and with the exception of a few incidental remarks, liable to the same objection, of aiming only at the discovery of the ultimate cause of sensation in general, but not accounting for what is more important, the nature of its specific varieties.

The only writer who has entered upon the subject systematically, and treated it in a manner purely physiological, is Bichât. He has both pointed out the proper mode of investigation, and furnished materials for prosecuting the inquiry.

The present attempt to extend our views is founded on similar principles to those contained in his Anatomie Générale: and to this valuable work the author is chiefly indebted for the assistance he has obtained.

Sensation has already been proved to result from changes going on in our bodily frame; and these changes are commonly

observed to proceed from the impression of external agents; as light impinging on the retina of the eye, or undulations of the air beating on the drum of the ear.

Certain organs being obviously adapted to receive particular impressions and exclude others, each has a mode of feeling peculiar to itself; and the organs of sense are usually distinguished into five, from the modes of sensation, which each is calculated to experience.

But the physical changes which our organs are liable to undergo, are not confined to those which proceed from the impressions of external agents. Every action performed by the body is productive of some change, and these, if augmented beyond their ordinary degree, are also liable to excite sensation; or the mind can feel in certain cases the changes attendant upon the actions of the body itself, as well as those produced by foreign agents applied to it. The sense of drowsiness, the periodical returns of hunger and thirst, and the painful sense of fatigue, belong to this class of feelings.

Now every organ that differs from another in structure, differs also in its mode of acting, and the modes of sensation produced, are as numerous as their modes of action.

Instead then of limiting our sentient organs to those by which the mind receives cognizance of changes produced by external agents, we ought strictly to admit into the number, those also by which we become conscious of internal changes going on: or instead of restricting their number to five, we should extend it much farther, and consider every difference of texture as a distinct organ of sense.

Even with respect to those which are adapted to receive the impressions of external objects, the question yet remains to be decided, whether, according to the view of Hartley, modified by Darwin, the *immediate object* of perception be not here also the vital action of the organ, rather than the physical action of the substance applied.

Without determining what may be the precise nature of the changes that excite sensation, it will be shewn that most of those feelings which are supposed to arise from the peculiar properties of the external cause, may be experienced

without that particular cause being applied; and consequently, the faculty of producing them depends as much upon the peculiar nature of the organ, as upon that of the external agent.

The objects however at present in view are, first, to ascertain the mode of feeling peculiar to each part; and then to shew that this peculiarity results from its particular organization; a point which will be sufficiently established unless there be some fallacy lurking under this apparently simple proposition.

When the same substance applied to different organs occasions different sensations, this diversity of feeling must arise from the difference of structure in each part modifying the impression received, or the change produced.

But when different substances applied to the same organ produce still the same sensation, this identity of feeling must arise from the peculiar structure of the organ, which adapts it to receive impressions and transmit them to the sensorium in this particular way, and no other; or, to express in a still more definite manner the share which the structure of the organ, on the one hand, appears to have in modifying sensation, and the quality of the physical agent, on the other; it may be stated thus:

That the mechanism of particular parts adapts them for receiving certain impressions impeding or intercepting others; hence each has a sensation peculiar to itself, which those parts are precluded from feeling, that want this organization. And when different causes are made to act upon the same organ, the impression is so far modified by the structure of the part which receives it, that the sensation still retains somewhat of the character derived from the peculiarity of the organ.

The influence of structure being then so extensive, there will be found as many modes of sensation as varieties of organization, and in analyzing each, we must minutely examine the texture of the part that experiences it.

Nor will it be sufficient to consider each organ in its entire state, or taken as a whole, but we must look to the primitive textures that enter into its composition, each of these having

a different way of modifying and transmitting the impressions it receives; or,

While there is one mode of sensation belonging to the entire organ, there are others belonging to its component parts; thus, the eye, the ear, and the tongue, have different textures and different nerves besides the optic, the auditory, and the gustatory, and by means of these can experience other sensations besides those of sight, hearing, and taste.

In like manner other parts of complex structure, as the skin, the mucous membrane, the stomach and intestines have certain feelings which they enjoy in common from similar parts entering into their composition; while each has one more exclusively belonging to itself.

It has been previously established that there are feelings continually excited in the body, which do not attract the attention of the mind, or awaken mental perception. Of such a nature are the habitual impressions made upon the heart and arteries, the stomach and intestines, which keep these organs constantly in action, without the mind being conscious either of the impressions made, or the actions performed.

The nature of these sensations is a question of no less importance, but requires a mode of investigation somewhat different, and therefore will be reserved for separate consideration; and we shall commence our inquiry with the more familiar mode, or that accompanied with reflex consciousness in the mind.

The mechanism of the organs of sense in the common acceptation of this term, so obviously fits them for receiving their respective impressions, that we are at no loss to conceive why each enjoys a mode of feeling exclusively its own.

The eye is alone adapted by its peculiar orginazation to receive the impression of light, and accordingly no other organ is endowed with the sense of vision; but the sensation of light or a luminous appearance may be transmitted to the sensorium without any light being admitted into the eye.

Thus pressing the finger on the eye ball causes a luminous appearance, and even several varieties of colour are produced

by it; rolling the eye about in the dark, has often the same effect; and from increased circulation in the head, these effects are known to arise without any external cause being applied.

Now this cannot proceed from the exclusive susceptibility of the eye to the impression of light, *no* light being admitted, and the effect being the same whether the eye be open or closed; but it must proceed from the nerve being calculated to excite this particular sensation, or to propagate its impressions in this particular way, rather than any other, though acted upon by different causes.

In a similar way a morbid change of circulation in the ear, or that part of the brain where the auditory nerve arises, often excites the sensation of sound, without any undulations of the air striking on the drum of the ear: thus sounds like the rolling of carriages, the falling of waters, the ringing of bells, and similar noises are familiar to persons subject to increased circulation in the head, and are sometimes the precursors of an epileptic or apoplectic attack.

Thus the different sensations of light and sound may be excited in their respective organs by mere change of circulation, and appear therefore to result from some peculiarity in their mode of receiving and transmitting impressions, and not from the physical nature alone of the agent applied.

The organs of taste and smell are particularly adapted for receiving the impression of saporous and odoriferous particles, and thence exclusively enjoy these faculties.

The numerous combinations of taste and smell produced by the physical properties of substances in the state of solution, or that of gas, might excite surprise, how an organ apparently so simple, should be capable of transmitting to the sensorium so great a variety of impressions. But the difficulty of accounting for it will be greatly diminished if we consider the mouth in its true light, not as a single organ, but as a combination of organs. The tongue, the cheeks, the palate, the uvula, the fauces, and even the nasal sinusses, separately contribute to modify the impressions of taste. If we examine the surface of the tongue, we find its papillæ vary in form, in

size and in number, at the extremity, the sides, the middle, and the root of this organ; and accordingly some substances make their impression on one part, and some on another. And, thus, peculiarity of structure appears to be as essentially connected with peculiarity of sensation in this as in other parts.

If we consider moreover how many of the varieties of taste are mere modifications in degree rather than in kind, and what a number of combinations may be formed out of the more simple sensations of acid and alkaline, bitter and sweet, saline and pungent, the difficulty will almost vanish, which at first presents itself, in explaining how the organs of taste may transmit impressions in such a variety of ways, with an organization apparently so simple.

It is not easy to adduce instances of the sensations of smell or taste, being excited like those of light and sound by mere change of circulation in the organs; perhaps the loss of moisture on the surface, incidental to increased circulation, deprives them of a condition essential to the exercise of these faculties.

Be that as it may, instances do sometimes occur, not only of perversion of taste and smell, but also of particular modes of them being experienced in a morbid state of the organs without any obvious external cause.

The sense of touch is considered as extending over the hole surface of the body, but more particularly belongs to the extremities of the fingers.

As the moist surface of the tongue is adapted for the impression of bodies in a state of solution, so the external surface is fitted for that of substances in a dry state. The one is calculated for receiving chemical, as the other is for mechanical impressions.

That the hand, considered as the organ of touch, is of complex structure, is evident; and different parts of it are appasently concerned in producing different sensations, like the different parts of the tongue in exciting different tastes.

Thus, as Darwin observes, the muscular fibres appear to constitute the organ that feels extension, pressure being

required to produce this sensation, which must more or less extend these fibres. The sense of hardness or solidity is excited in the same way, and probably has its origin in the same part of the organ.

Other modifications of touch do not require the same degree of pressure for their production, and probably proceed from other parts of the organ: thus,

The sensations of roughness and smoothness are perceived by passing the hand lightly over the surface of bodies, and appear to have their seat in the papillæ, with which the skin, like the tongue, is said to be provided.

The sense of titillation is produced by the slightest possible degree of roughness, or by substances brushing lightly over the skin.

The cuticular covering appears to be that part of the organ which produces this peculiar modification of feeling. The cuticle is not the seat of this sensation, being itself insensible; but its interposition serves to modify the impressions received by the sentient papillæ beneath.

Accordingly itching, which is a modification of titillation, is confined to parts exposed to the air and covered with cuticle, as stated by Bichât. These are, the external surface, or the skin, the inner surfaces of the nose, the fauces, the ear, the eye-lids, &c.

When the cuticle is removed, this sensation is superseded by another, that of smarting; and the itching of an ulcer denotes its healing, or the return of cuticle. Thus, this particular organization appears essential to its production; but the peculiar nature of the external cause applied is far from indispensible, as it arises from a variety of causes.

It is commonly occasioned by, and hence, conveys to our minds the idea of something passing lightly over the surface, as the creeping of an insect, or if stronger it resembles a flea-bite, or sometimes it appears like the stinging of nettles. The actual application of any of these causes is not however absolutely required to produce it. It often arises spontaneously, or proceeds from a variety of impressions no way resembling each other. Thus it accompanies most papular

and cuticular eruptions, but does not arise from those which are more deeply seated, unless when the cuticle is interested or desquamation attends, as on their decline. It is often produced on the skin, from affections of the stomach, as in urticaria or nettlerash. It is felt at the nose and at the rectum from worms in the intestines; at the extremity of the urethra from stone in the bladder; in the wind-pipe exciting cough, from disease in the lungs, no external cause being actually applied in these cases, to the part which experiences the sensation.

The sensations of heat and cold, as stated by Darwin in his Zoonomia, by Dr. Currie in his Medical Reports, and by Bichât, in his Anatomie Générale, appear to be almost confined to the external surface; or to be felt but vaguely and indistinctly in parts deeply seated.

Thus ice ceases to be felt as soon as swallowed, and liquids hot enough to scald the mouth are scarcely felt in the stomach.

The sense of smarting is nearly allied to that of heat, differing from it only in degree. If we hold the back of our hand to a strong fire, it first feels warm, then hot, and at length smarts.

Hence it appears probable, that they are produced by the same cause, and originate in the same part. The following considerations, seem to lead to the conclusion that the immediate seat of these sensations, is the network of subcutaneous vessels, termed the rete mucosum.

Whatever causes these vessels to contract or shrink, excites the sense of cold, and whatever distends or fills them produces the sensation of warmth: thus hæmorrhage, fainting, sickness, fear, ague, &c. occasion the former; while stimulants, cordials, shame, anger, bodily exertion, fever, and inflammation produce the latter.

These causes are all attended with an actual change of temperature on the surface, but still there is reason to conclude that the sensations of cold, heat, and smarting, depend rather upon some peculiar change of condition in the cutaneous vessels, than upon the actual temperature. For the same changes of circulation in other parts where there is every

reason to believe the same changes of temperature, are not productive of the same sensations.

That the object of perception is not the caloric, entering or leaving the body, but the change of condition in these superficial vessels attending its addition or abstraction, appears probable from this, that the feelings bear a more uniform relation to the state of the vessels than to that of the temperature.

Thus, in the pungent heat of erysipelas, the increase of temperature, as proved by the thermometer, is no way commensurate with the sensation experienced; nor is the reduction of temperature adequate to the painful sense of cold which attends the shivering of an ague.

The smarting of a burn or scald continues with little abatement long after the external cause is withdrawn, and the real temperature of the part only a few degrees higher than natural.

By plunging the part in cold water the pain is alleviated, for the action of the vessels is thus allayed; but the sensation returns when it is taken out, for the action of the vessels is then renewed.

The immediate object of perception thus appears to be the change of condition in the vessels, and not the calorific matter entering or leaving the body.

The peculiar nature of the changes in those cutaneous vessels which excite the different sensations in question, are probably as follows.

Shrinking or contraction causes the sense of cold; gentle relaxation, warmth; a greater degree of fulness or distension, heat; and inordinate distension causing painful efforts of resistance, smarting.

That the state of vessels which occasions smarting or burning in an inflamed part, is not simple distension, but an inordinate effort to resist distension, appears, as suggested by John Hunter, from this; that the pain is often alleviated by means that increase the distension. Thus an emollient poultice by allaying these efforts, moderates the pain, but often increases the swelling; witness the alleviation of pain that

ensues as the face swells after rheumatism or tooth-ache; or as the toe swells in gout; and the difference between acute and chronic inflammation, the pain being greater in the former while the action of vessels continues, but the swelling being greater in the latter, when the action of vessels subsides. Further,

External cold, when it excites vascular action, produces a sense of warmth; thus walking against a keen frosty air, brings a glow into the face. And the extreme of cold as well as of heat excites smarting, both producing a painful contraction of vessels; hence salt and snow, or frozen mercury, seems to burn the hand.

Such are the various modes of sensation arising out of the complex structure of the organ of touch, and similar varieties will be found if we turn our attention to internal parts.

The mucous membrane lining the internal surface, is in fact a continuation of that investing the organs of taste and smell, adapted likewise for receiving the impression of substances in a state of solution, and in like manner variously modified.

The inaptitude of the skin to receive chemical impressions appears partly to depend upon its cuticular covering. This is not however the only circumstance in which they differ, otherwise we should be able, as soon as the cuticle is removed, to perceive the impressions of saporous bodies on the surface, as well as on the tongue; or in other words, we should be able to taste with our skin.

But this is far from being the case; and it is evident, moreover, that a wide difference still remains between the structure of the two organs; nor are the varieties of sensation to be ascribed to variation of structure of so palpable a nature as that between the skin and mucous membrane.

There are in fact no two parts of the same membrane, as Bichât remarks, which have exactly the same texture; and corresponding varieties appear in their modes of feeling. Thus, as before stated, the papillæ of the tongue vary in form, size, and number, at the root, the middle, and the point of that organ; and accordingly some substances make a stronger impression on one part, and some on another.

Similar differences prevail between different parts of the mucous membrane lining the alimentary canal; and hence the diversity of feeling between the palate, the fauces, the œsophagus, the stomach, and the intestines; and consequently substances that act upon one part powerfully, act but feebly upon another. That which is emetic, may not be purgative, and medicines may act upon the intestines, which make little impression on the stomach.

When either of these organs is powerfully affected, the sensation awakened depends upon the peculiarity of the organ, not the peculiar nature of the substance.

The sense of nausea arises from certain impressions on the stomach, but is not the immediate perception of the substance applied, or of its physical properties, for the sense of nausea continues the same, although caused by fifty different substances bearing no affinity or resemblance to each other in sensible qualities, as ipecacuanha, tartarized antimony, simple warm water, the motion of a swing or a vessel, air pressing on the upper surface of the organ, the force of imagination, &c.

The sense of griping is produced by certain impressions acting powerfully on the intestines; but like nausea in the stomach, is produced by a variety of substances not at all resembling each other in sensible or physical properties, and the sensation therefore depends upon the peculiarity of the organ, not the peculiarity of the agent.

Griping may arise from acids, from purgative medicines, from flatulency, from external cold, or from mental emotions; and is analogous to the sense of nausea in the stomach.

The sense of thirst, though felt chiefly in the fauces, appears to originate in the stomach, and, being alleviated by liquids, is commonly ascribed to the expenditure of the fluids on the internal surface.

But thirst proceeds from other causes besides the want of liquids. Drinking to excesss is even known to bring it on, while it is frequently removed without drinking at all, and sometimes by the abstraction of fluids from the body instead of

the exhibition of them; thus venæsection, purgatives, and sudorifics, allay it in inflammatory fever.

It depends therefore upon some peculiar condition of the organ, and not the peculiar nature of the cause exciting it. Upon inquiring into this condition there will appear to be a near affinity between the changes which excite the sensations of cold and heat on the external surface, and those which occasion the sensations of nausea and thirst on the internal.

The sense of nausea and that of coldness usually accompany each other; and the sense of heat is usually attended by that of thirst. Hæmorrhage, syncope, fear, and ague, occasion the sense of nausea as well as that of cold. Bodily exertion, strong stimulants, fever, and inflammation, produce thirst as well as heat: and when the sensation is strong we often prefix the epithet of "burning" to thirst. Thus the two former appear to be concomitant effects from the same cause, or to proceed from whatever occasions a considerable shrinking of the capillary vessels, while the two latter result from whatever occasions a considerable fullness or distension of these vessels.

This connexion points out the probability of their proceeding from corresponding changes in the superficial vessels of the internal and external surfaces; the difference of texture between each appearing sufficient to explain the diversity of sensation. The consideration of this question will be resumed hereafter, and the analogy between these sensations more clearly shewn.

Hunger is another sensation peculiar to the stomach, arising when the organ is in a state of vacuity, and alleviated by a certain degree of repletion; hence it appears connected with the variation of quantity in its contents.

As the muscular fibres, according to Darwin's idea, appear to constitute that part of the organ of touch by which we acquire knowledge of the quantity or extension of external objects, so we shall hereafter find reason to conclude that the muscular fibres constitute that part of the stomach by which this organ takes cognizance of change of quantity in its contents.

Like other sensations, however, it seems to proceed from some vital change in the action or condition of the muscular coat, and not from the mere mechanical state, with respect to distension or collapse. For the sense of hunger often arises, in persons of weak digestion, before the stomach is half empty, and again it usually ceases spontaneously while the organ remains empty, if we fast much beyond our accustomed period of taking food.

What the particular state of the fibres is, which occasions this sensation; why it occurs in a state of vacuity, and is relieved by a certain degree of repletion, will be considered hereafter: when it will be more clearly proved to originate in the muscular coat, being analogous to that state of painful contraction experienced by other parts of muscular structure, which arises from long continued exertion, and is denominated fatigue in the organs of voluntary motion.

To these organs we shall next direct our attention, and we shall find that they also have different modes of sensation, arising out of the various textures which enter into their composition.

The sense of lassitude or fatigue is confined to muscles, as remarked by Bichât, and usually proceeds from over-exertion. In the common acceptation of the term it is experienced only in the organs of locomotion; but it occurs, as we shall find, though under different modifications, in all parts of muscular structure; thus hunger, as before stated, is the fatigue of the stomach.

Though commonly produced by over-exertion of the muscles, it may arise from other causes besides muscular action, or without any previous exertion; thus it arises from altered circulation, and prevails constantiy in chronic rheumatism; is distressingly felt in all the muscles at the commencement of fevers; and therefore depends upon the peculiar condition of the organ, and not the particular nature of the cause exciting it.

When we inquire more minutely into the nature of the change in the moving fibre, which occasions this sensation, we shall find that the term fatigue is used to express two states, one of which is active, and the other passive; or, one

is the pain attending overaction, and the other is the inability to act, or aversion to motion that succeeds. Both will be found connected with change of circulation in the moving organ.

The feeling we call a sprain, or the sense of contortion, is the only one, according to Bichât, possessed by ligaments and tendons; hence, this is the pain attending a sprained ankle, or the dislocation of a joint. It appears from Bichât's experiments, that these parts in the healthy state are insensible to every mode of irritation but that of twisting or stretching. When laid bare in the leg of a dog, no mark of pain was excited by cutting, burning, or pinching them; but the animal strikingly evinced his sufferings when they were twisted or stretched.

It is not requisite, however, that they should be twisted to excite this sensation, which, like others already enumerated, arises without the application of this cause, from mere change of circulation. Thus it is experienced in gouty and rheumatic affections, which have their seat chiefly in parts of ligamentous and tendinous structure.

Contortion appears to be only a mode of extension; and a further variety of this feeling occurs in another structure, namely, fibrous membranes; which, according to Bichât, should be regarded as belonging to the same class of organs, or as approximating in their nature to that of ligaments and tendons, though differing in external form.

This modification is the sense of tightness or tension, experienced in fibrous membranes, or in parts resembling them in structure. It is felt round the head, from constriction of the scalp in the cold fit of ague; sometimes in the integuments of the abdomen, during inflammation of the intestines: the sensation attending whitlow in the finger, is a modification of this feeling; and in all these it is evidently connected with change of circulation in the part that experiences it.

As the muscular and tendinous structures are blended together, or occasionally pass by imperceptible gradations from the one to the other; so the mode of feeling is sometimes

intermediate. Thus the pains of rheumatism vary according to the structure of the part affected, appertaining more to the sensation of fatigue when the disease is seated in the muscles, and to that of contortion or sprain when it reaches to the tendons.

In the same way those muscles which approximate in structure to fibrous membranes, partake of the mode of feeling peculiar to these parts. Thus a sense of constriction or tightness is felt in the intercostal muscles on going into a cold bath; and the pain of pleurodyne or rheumatism of the intercostals is sometimes so acute as to be confounded with that of pleurisy, which originates in another texture.

This sensation is peculiar to serous membranes, and may rather be termed lancinating or lacerating, and is experienced in acute inflammation of the membranes covering the lungs, the liver, the stomach, the intestines, and other viscera.

This membrane in its healthy state is lubricated with the serous fluid exhaled from its surfaces; and the motion of the organ enveloped by it, is thus facilitated. But in the inflamed state, its surfaces become dry, and have a tendency to adhere together. These adhesions when actually formed must impede in a certain degree the motions of the viscera, and thus occasion some stretching of the membrane; or when imperfectly formed they may be torn asunder again by the motion of the organ, and occasion thereby the sense of laceration experienced.

Whatever share this mechanical cause may have in its production, it seems to depend more immediately upon the state of circulation in the parts; for adhesions are constantly found after death, in persons who experience little or no uneasy sensation from them while living, unless when attended by actual inflammation.

Another mode of sensation is that peculiar to bone, which though nearly insensible in health, excites most acute pain in the state of disease.

The sense of aching occurs only in bone, but may be also modified according to the texture of the parts that enter into its composition. Thus there appears to be one mode belonging

to its periosteum or fibrous covering, and another to its medullary portion.

That which arises in the periosteum is produced by undue pressure on the surface, as aching proceeds from any thing pressing on the shin-bone. It arises, however, from other causes as well as from external pressure, as from nodes and inflammatory affections of the periosteum. Some forms of head-ache, ear-ache, and chronic pains of the face, appear to belong to this mode of sensation; and the joints are peculiarly susceptible of it, from exposure to cold or vicissitude of temperatare, for want, as observed by Morgagni, of that fleshly covering by which other parts are protected.

The mode of sensation peculiar to the medullary part of the bone, is familiar in the form of tooth-ache. The teeth have no fibrous covering on that part which is exposed, and do not experience in this the sense of aching from external pressure. Neither does the medullary portion appear very sensible to mechanical impressions, unless in the state of inflammation, as during incipient decay, and then it is often acutely painful without any obvious mechanical cause being applied.

Thus it appears that all these varieties of sensation, derive their peculiarity more from the structure of the part which experiences them, than from the nature of the external cause which excites them; or, the mode of transmitting the impression determines the sensation, rather than the peculiar nature of the impression applied.

Having thus endeavoured to point out the immediate seat of the principal varieties of sensation, and the physical cause calculated to excite each, it is well worth our notice to observe their final cause; or in other words, the use and end for which they appear designed.

That each part should have a mode of feeling peculiar to itself, seems on every account expedient, as without this, we could judge with little accuracy of the seat of internal derangement; and in deep seated organs, changes might be effected prejudicial to the animal economy, without our

receiving timely notice, or being prompted to seek the suitable means of relief.

But each, from its peculiar organization, being calculated to awaken a different sensation, when affected by certain impressions, the mind soon learns to distinguish the part from whence the feeling proceeds.

Further, it appears that each part has its sensibility peculiliarly adapted to the office it is meant to perform, or the organ it has to protect. Thus, each part is exclusively sensible, as remarked by Bichât, to those impressions which may prove injurious to its structure, but is partially or wholly insensible to those, to which it is not liable to be exposed, or by which it is less likely to be injured. Thus, aching is exerted by undue pressure, almost the only cause from which bone is liable to suffer. Distortion is most likely to injure the joints; and this feeling is the only one posssed by ligaments which serve to defend them. Over exertion may prove injurious to muscles, and the sense of fatigue is accordingly confined to them, prompting us to discontinue our efforts in time. The sensation would be superfluous in involuntary organs. The internal surface is little exposed to vicissitudes of temperature; the senses of heat and cold are hence chiefly confined to external parts. Itching, if perceptible, where the hands could not afford relief, would be a source of constant misery, and is therefore felt only on the cuticle.

Thus we find, that to each part is allotted that share of sensibility, and that mode of feeling, which are necessary for the welfare and protection of the organ to which it belongs; and these might be added to the many instances, so beautifully described by Dr. Paley, in his admirable work on Natural Theology, as displaying manifest design and intelligence in the works of creation.

Beside these feelings which strongly awaken attention in the mind, and warn us of extraordinary impressions, or such as are liable to be injurious to our organs, we have yet another class of sensations which are never thought of, or reflected upon.

Such are those abstract, or unreflected sensations, which, without any conscious act of volition, prompt us to perform alternately inspiration and expiration, which keep in constant action the heart, stomach, and intestines, and every organ and vessel throughout the body, without our being so much as conscious that these actions are going on.

To ascertain the nature of these impressions, when their very existence as a mode of sensation has been doubted, may at first appear difficult, and yet is not impossible.

Their existence is inferred from their effects, and careful observance of these effects will enable us also to ascertain their nature.

Unfortunately, however, for the advancement of science, this is not the mode that has been pursued. Conjecture has been substituted in the place of observation, or delusive experiments have been recorted to, which have served only to lead to error.

No sooner was an impression, or something to act as a stimulant deemed necessary to excite involuntary organs to action, than this power was ascribed to the fluids they contained, no other agent being applied to them.

But this doctrine has been carried further, and a specific power or property has been assigned to each particular fluid, which is supposed to adapt it in a peculiar manner for stimulating the organ that contains it.

Having obtained almost universal assent, the objections to this view require to be fully stated.

It rests on assumption instead of observation, and appears on every account objectionable.

In the first place, the principle assumed appears to be gratuitous, and contrary to general analogy. In the next place, if granted, this principle would not explain the phenomena; and lastly, we shall find another cause, the presence of which cannot be denied, and which every way accords with the phenomena.

First, the assumption that the fluids are stimulant or irritant to their proper organs, appear gratuitous and unfounded.

If any definite meaning be affixed to the word stimulant

as applied to the fluids of the body, it must imply either their mechanical or their physical mode of action. But when we speak of a peculiar quality in the fluids, which renders them stimulant to their respective organs, it is clearly not their mechanical impression that is alluded to, this being no peculiar quality, but common to all. It is therefore some chemical or physical property that is supposed to render them stimulant.

Have we then any instance of substances acting in this way, so as to excite a sensible impression on our organs, *which if constantly applied, continue to produce the same effect, and yet without altering the nature or texture of the part acted upon?*

The principles of sensation offer nothing analogous to this; on the contrary, experience and observation prove that the strongest stimulants, if held long in the mouth, lose their power of impression. While at the same time their frequent repetition changes the nature of the organ: thus, our tastes are continually varying, medicines constantly used lose their influence, and virulent poisons often become habitual, and cease to excite irritation.

It seems therefore highly improbable that fluids comparatively mild and bland in their nature, as the serum and blood, natural as it were to the organs, and in perpetual contact with them, should excite irritation.

But we are told that this irritating quality in the fluids, has been proved by experiment. And what is the nature of these experiments? The contents of one organ prove irritating if applied to another. Thus the contents of the intestines or bladder are irritating to the stomach; and those of the stomach or of the blood vessels are irritating to the bladder.

And does this warrant the assumption that they are also irritating to their own proper organs, which are in perpetual contact with them, and used to their impression, because they are found irritating so those which are wholly unaccustomed to them?

So far from it, these very experiments lead to the opposite conclusion if duly considered; for now that the substance

applied is really irritating to the organ that receives it, the natural action of this organ is changed, and it gives proof of being irritated.

Instead of enduring it resists the impression, and rejects the cause applied, by efforts widely different from the regular and uniform mode of action habitual to it.

But it is further urged, that the organs afford often proofs of being irritated by their own proper fluids; thus the stomach often rejects its contents by vomiting, and acrimony in the bowels occasions purging.

In these instances, either the irritability of the organ is increased, or the quality of its contents is changed; and no doubt but the contents of any organ may become irritating when altered from their natural condition, since it is the uniformity of their nature that prevents their being so at other times.

But when the quality of the contents varies, the action of the organ varies also, and morbid effects arise. Thus, if the stomach be itritated, eructations and nausea ensue; if the intestines, diarrhoea or purging is the result. If the urine be irritating to the bladder, frequent micturitis arises. If the contents of the capillaires be changed, shrinking, paleness, and chilliness, as occurs after meals in persons of weak digestion and imperfect power of assimilation.

That the organs are sensible to unusual impressions, or to those which are not permament and habitual, can never be questioned.

To what else do medicines owe their power of action? Why do they alter the natural action of the organ, but because they are incapable of being assimilated like the materials of nutrition, and therefore, excite an impression which is novel and strange, and thereby occasion those *efforts which procure their rejection?*

But this affords no ground *for assuming that the natural fluids act in the same way, or that any organ secretes a fluid to irritate itself.*

Secondly, *if granted, this principle is wholly irreconcilable with the phenomena.*

Thus the action of involuntary organs is a periodic action,

consisting of contractions and relaxations, alternately and regularly succeeding each other; their explanations therefore appear to require a cause alternately applied and withdrawn.

But this will not be the case in any instance if the physical quality of their contents be the exciting cause; for none are wholly relieved from that impression by the efforts of contraction they exert, but on the contrary, most organs remain after contraction in contact with their contents as well as before; and even the heart and urinary bladder, which most nearly empty themselves, retain a moistened surface.

Again, many organs remain some time in contact with their contents before signs of irritation appear.

The stomach shews no signs of irritation from receiving the food, but gradually relaxes or yields for its admission, resting for a period after its reception. At length, however, it resumes its peristaltic action of alternate contractions and relaxations, in a manner coinciding with a cause alternately applied and withdrawn, not constant and unremitting. The intestines act also in the same periodic manner. The colon, though in perpetual contact with the fæces, shews no signs of irritation except once in twenty-four hours, and then it makes a periodic effort of contraction. The bladder also, in perpetual contact with the urine, shews no signs of irritation from its presence in the natural condition of that fluid, but at stated periods only, contracts for its expulsion.

Thus the phenomena of remitting and periodic action no way agree with the assumption of a cause, permanent and unremitting, if such a property could be ascribed to the fluids contained by them consistently with the laws of sensation. But no such quality in their healthy state appears to belong to them.

Lastly, we proceed to shew that the actions of involuntary organs are excited by a cause liable to none of these objections, and every way according with the phenomena. This cause is simple mechanical distension; a cause which is alternately applied and removed, and is therefore periodic or intermittent, like the action of the organs; a cause which produces no chemical change in the part affected, and therefore is not liable to impair its susceptibility from frequent

repetition; and lastly, a cause which is little subject to variation; but whenever it varies, producing a corresponding fluctuation in the action of the organ.

Thus, in the natural state of the fluids, the heart waits to be distended before it contracts upon the blood; but its pulsations are quickened by exercise, because it is then more quickly and forcibly distended.

The lungs in their collapsed state do not allow the free transmission of the blood, which propelled onward by the action of the heart, painfully distends the obstructed vessels, and prompts to an effort of inspiration. The dilated thorax allows a free transmission; and the expanded chest, now sinking again by its own weight, compresses the vessels and helps to propel the blood on towards the heart, till a fresh accumulation calls for fresh relief to be obtained by a second inspiration; and thus respiration is regularly and uniformly effected.

The stomach also acts intermittingly, and requires therefore an intermitting cause. At every act of inspiration the stomach is compressed along with the liver and intestines between the abdominal muscles and the descending diaphragm; and as long as any thing is contained in it, it will thus be subjected to a mode of distension, alternately applied and withdrawn at every inspiration and expiration.

The peristaltic motion of the intestines proceeds from a similar cause; one set of fibres contracting propels the ingesta forward and distends another; these contract and distend a third; while the general effect is increased by the alternate ascent and descent of the diaphragm, on which account, amongst others, exercise, by quickening respiration, promotes digestion.

The colon receiving the fæculent matter thus gradually transmitted to it, propels it onwards by slow degrees to the rectum; which shews, on receiving it, no signs of irritation until distended to a certain point, and then it contracts for the expulsion of its contents.

The bladder, in like manner, when distended to a certain

degree with urine, first begins to be uneasy, and relieves itself by contraction. Thus it appears, that in the healthy state of the fluids, they are not irritating to the organs in perpetual contact with them; as they shew no signs of irritation until their quantity be such as to excite distension.*

The natural and habitual stimulus to muscular structure is the mechanical distension of its fibres, as suggested by Darwin, and by this are involuntary organs excited to contraction; the specific properties of the different fluids being perceptible by those organs only which are unused to their presence, or by their proper organs, when these fluids are imperfectly assimilated, or changed from their natural and healthy condition.

The division of moving organs into voluntary and involuntary is partly arbitrary, for even voluntary organs are frequently found to act without any interference of the will.

If we inquire into the cause that excites them in these cases, we shall find that this also is mechanical extension.

The muscles at the back of the neck are stimulated to contraction by the tendency of the head to fall forward. The weight of the lower jaw is a stimulus to the muscles which support it, and this without any continued act of volition is sufficient to keep them in action, and prevent its falling. The eye-lids are somewhat distended by the prominent roundness of the eye, which is sufficient to keep them in action during the day without a distinct effort of the will; but towards night, when fatigue succeeds to long continued action, these organs have all a tendency to relax. And thus as sleep comes on, the chin falls upon the breast, the jaw drops, and the eyelids close.

Other voluntary muscles may also at times be made to act automatically, from the stimulus of extension variously applied to them; as those of the back and abdomen in keeping the body erect, which perform their office spontaneously in persons trained to sleep on horseback; those of the limbs, in walking, which are extended by the contraction of their antagonist muscles, and give sometimes evident proofs of

their spontaneous contraction if suddenly or violently extended. This often occurs in a sprain, which usually affects the opposite muscles to those on which the force was directly applied, the reaction of the antagonists causing the principal injury. In short, mechanical extension appears to be the natural stimulus to parts of muscular structure; and instead of a multitude of different impressions, which the sentient principle was heretofore supposed to perceive and correspond to, at the same instant in different parts of the body, there appears in the natural and healthy state only one cause of involuntary motion, morbid action arising wherever another is substituted in its place.

Such are the conclusions which, in the present state of our knowledge, we are led to draw respecting the origin of the varieties of sensation; and which, however imperfect, may contribute in some degree, it is hoped, to enlarge the sphere of our knowledge, or at least keep alive the spirit of enquiry.

ART. II. *A Report on a Memoir by Signor* MONTICELLI, *perpetual Secretary of the Royal Academy of Sciences of Naples, entitled " Descrizione dell' Eruzione del Vesuvio avvennuta ne' giorni* 25 *e* 26 *Dicembre,* 1813. *By* A. B. Granville, *M. D. F. L. S. M. R. C. S. &c. For. Sec. Geol. Soc.*

EVER since the eruption of 1812, it had been remarked by those who had occasionally visited the volcanic summit of Mount Vesuvious, that its ancient crater had undergone very material changes; the continual throwing up of fused lava and vitrified matter had formed a kind of arch or dome, under which the great cavity lay concealed. Long and deep crevices, filled with the same materials, running in different directions, from the margin of the concealed crater, down the sides of the volcanic cone, announced the violence of the last eruption.

All around the declivity, and even much beyond it, as far as the cultivated plains, lavas, scoriæ, black pumice-stones, and ashes had covered the subjacent soil; but no other opening, through which such a vast quantity of materials could have issued, was visible, except a small one on the eastern side of the volcanic cone, about eleven feet in diameter. There was, indeed, on the north side, another very small aperture, which, no doubt, had been active during the same eruption, but which must have been very insignificant; since its action was soon diminished, and ultimately annihilated by the accumulation of the very substances it had thrown out.

During the whole of 1812, and the first part of the following year, the former of the two openings above described had not ceased to throw out, at times, ashes and pumice-stones, besides great volumes of smoke followed by flames. These occasional emissions became more energetic in the month of May of the same year; and some slight shocks of an earthquake being felt, and loud rumbling noises heard in the neighbourhood of the mountain, an approaching eruption was confidently expected. Calm, however, succeeded these threatening phenomena; and the air becoming clear and serene became likewise insufferably warm.

The winter of 1813 had been unusually rainy and severe. A great quantity of snow had fallen in various places: yet Signor Monticelli remarked, to his great surprise, that about the middle of May, when the spring heat had scarcely begun, the water in some of the wells at Torre del Greco, had diminished by nine palmi (six feet nine inches), while the level of the water in the great well near the fountain of Collimuzzi at Resina, fell twelve feet eleven inches (fifteen palmi) lower than usual. A similar phenomenon had been observed by Monticelli in another place, where the spring water of a recent well became suddenly lower by six feet (eight palmi.)

The author here takes the opportunity of introducing into his Memoir a note, which from the interesting nature of the facts it conveys, and from these being connected with the excellent observations on sea shores, lately communicated to

the Geological Society by Mr. Stevenson, deserves to be particularly attended to. It appears, then, that the sea, which on the coast called the *Uncino*, at a short distance south of Naples, had been thrown back, in the process of time, to a considerable distance by the torrents of lava and other volcanic productions, is now, again, making its way towards them, breaking down before it the embankment they formed, and flowing over them to a considerable height. This elevation of the water in the bay of Naples is common to the north and south shores from Sorento and Pozzuoli, at which latter place some ancient Roman buildings are distinctly seen under water, while others stand on the very verge of it. The coast of *Uncino*, alluded to by the author, is particularly interesting to geologists. It is entirely formed of stratified lavas of different ages, and by distinct arrangements of other volcanic productions. The spring water which is found on various parts of this coast is distinctly acidulous, while that of the sea, nearest to it, is occasionally covered with bubbles of an aeriform fluid, and is of a higher temperature than the rest. The depression of the water in the springs, is considered by the people in the neighbourhood of Vesuvius as the forerunner of an imminent eruption; and there is hardly any doubt, as Signor Monticelli observes, but that it is connected with that extraordinary phænomenon. In the present instance, however, the volcano merely threw out some clouds of smoke and a few ashes.

On the 17th of May and the 9th of June the sea was observed in different parts, as at Portici, Resina, Torre del Greco, Uncino, and Gioaccinopoli, but in all at the same time, to recede on a sudden to the distance of from ten to fifteen yards from the shore, a phænomenon which had always preceded the most dreadful eruptions.*

During the months of June, July, and August, the west and south winds brought almost constant rains with them, notwithstanding which, the depression of the water in the

* It is needless to observe, that the ebb and flow of the tides are unknown on this coast, and generally in every other part of the Mediterranean.

wells already mentioned, continued to increase to such a degree, that in the one destined to supply the great fountain at Resina, the quantity of that fluid left was quite insufficient for the purpose, its surface having fallen more than thirty-nine feet below its original level. This drying up of the water extended to the river *Sarno*, and in general to every considerable body of water in that part of the country, so as to threaten the inhabitants with an approaching drought even after three months of constant rain.

I shall not dwell on the author's attempt at an explanation of this phenomenon. His conjectures are ingenious, though not satisfactory—so that little interest could be excited by the knowledge of what he may advance in support of any particular theory.

While the progressive decrease of water was going on during the period above alluded to, the mountain gave strong marks of internal commotions. There were occasional detonations, followed by the emission of smoke, ashes, and flames, attended with slight oscillations of the ground around it. These were repeated, but with much greater activity, every night during the month of August. On the 26th of that month a gigantic column of flame rose rapidly, amidst reiterated explosions, from above the circular bason of the volcano, and appeared to stand waving towards Torre del Greco, impelled by the north-east wind then blowing rather fresh. Similar occurrences, more or less alarming, continued every successive night, until the inward workings of the mountain seemed gradually to subside, and the whole became silent and calm.

The manner in which this part of the Memoir is drawn up does infinite credit to Signor Monticelli, both on account of the clearness of his descriptions, and the precision which appears on the face of even the most minute of his details.

It ought to be remarked, that the thermometer constantly and suddenly rose after the occurrences in August, and that in one instance particularly, when a general calm prevailed, the temperature had increased from 66° to 76° Fah. This temperature continued till the 26th and 28th of October. During both these nights the volcano threatened new and

approaching eruptions. The vivid flashes of lightning and the flames that succeeded each other with astonishing rapidity, pierced through the darkness of the horizon, and presented to the trembling spectators the volcanic cone enveloped in clouds of smoke. The deep and distant roarings of the convulsed mountain, like those of a tempestuous sea, were interrupted only, at intervals, by the loud and shrill detonations that filled every one with horror. Those nights were spent in the agonies of distressing expectation. At last a heavy rain, mixed with hail, fell, and in an instant overspread the steep declivities of the mountain and the country around it. Day came, and with it calm, and a serene atmosphere.

Signor Monticelli having now left the neighbourhood of Vesuvius, mentions, that nothing of importance occurred till the latter end of December, the epoch of the formidable event related in the Memoir. On the 25th of that month the air was dense and black; and heavy clouds, gathered around the summit of the mountain by a strong easterly gale, concealed it from view. "Towards ten in the morning," such are the author's words, "a few detonations, the origin of which appeared at first dubious, were heard at short intervals. But the shocks of an earthquake that closely followed, and the internal roarings of the mountain, announced, too well, what was the event to be apprehended."

It is in this particular part of his Memoir, that the author displays great skill in detailing his observations, and with a force of language that gives additional interest to his description. Aware of the approaching eruption, the author had in company with a friend, returned to Vesuvius on the eve of its occurrence, and took his station on the most favourable spot for viewing the marvellous events of the 25th and 26th of December.

The wind, which had shifted a little from the east to the north, gradually dissipated the clouds from around the mountain, whose bellowings were every moment becoming louder Flames and smoke made their appearance, at short intervals on the crater, when at last, at two in the afternoon, after one

of the most terrific explosions, and uninterrupted, loud, and deafening roarings, an immense torrent of fire, preceded and followed by a lofty column of dense black smoke, filled the great bason, and quickly overrunning the margin, descended on all sides of the volcanic cone towards the *Fosso bianco.* In the mean while the ancient mouth of 1812 was throwing out with incredible fury, smoke, ashes, and ignited stones in every direction.

It is remarked by the author, that when the superior part of the high column of smoke, already mentioned, had been considerably deflected from its perpendicular direction by the wind, it re-ascended a little, and having discharged the heaviest of the volcanic products with which it was loaded, while it swept along with it the lightest, separated into two distinct parts; one of which, hovering over the resplendant liquid lava, descended along with it, depriving it occasionally of its lustre; while the other, remounting the acclivity of the cone, rushed over the edge of the crater with singular impetuosity, and was lost in the vortex of the heaving cavity, till it again mixed with the perpendicular column of smoke which continued to be thrown out.

This retrograde movement of the descending torrent of smoke was attributed by some of the author's friends, who were present, to a current of air, which might have been running in a different direction from that of the wind then blowing; but Signor Monticelli, with greater probability, conceives that such a phænomenon cannot be properly explained by such a gratuitous supposition; and must wholly be attributed to the rarefaction of the air over the volcanic bason, which rarefaction, during the violence of the eruption, must have been very considerable, and would, according to the principles of mechanical philosophy, occasion the retrograde movement in question. The display of this phænomenon in its extent, and duration, depends upon the degree of force in the accompanying circumstances.

Evening was now approaching, and the over-spreading of the fire at the top of the column added much to the terrific beauty of the scene.

But who shall describe, exclaims Signor Monticelli, in its true colours, without being suspected of a poetical imagination, the effects of the much increased violence, and the prodigious agitation of the burning pit during the night? Lightnings, quicker than imagination can conceive, and convulsive throes of dazzling flames, whose height doubled that of the mountain, maddened the intellect, and pained the eye even to bursting; the thundering noise of a thousand explosions, before which the rumour of a hundred cannons is like the rustling of a passing wind; the bright red boiling lava, resembling liquid fire, rushing down the declivity with inconceivable impetuosity; the occasional bursting of the smoky whirlwind, causing a horrible shower of red hot rocks, flints, ashes and pumice-stones—and monstrous burning masses bounding and rolling down the rugged sides of the labouring mountain, chilled the blood in the very heart of the spectators.

It is difficult to do justice to the strong and vivid description of Signor Monticelli by the limited abstract to which a report must be confined. An idea may be formed of the distance to which the ignited substances were launched into the air, when it is known that some of them took from ten to fifteen seconds in descending; and of the size of some of those substances, by that of one of the pumice-stones found afterwards by the author, nearly one foot in length, and from three to four inches wide.

The short calm which succeeded the horrors of the night of the 25th was again interrupted by the eruption which happened on the following day, and to describe which language seems inadequate. This, like that of the former day, was preceded by south winds, and accompanied by fresh easterly gales, which cleared the atmosphere of every cloud. During one of the explosions a huge mass, forming part of the volcanic cone, was forcibly torn from the mountain, and precipitated down its sides. The violence of these explosions was such, that the largest houses, the churches, and even the Royal Palace of Naples, where its effects were most forcibly felt, shook visibly, and for some time; the doors and windows were frequently

thrown open or broken; and the agitation of the air was otherwise exhibited by many singular phænomena. On this day the eruption threatened destruction to several villages in the neighbourhood, and forced the inhabitants to seek safety in flight, abandoning every thing they they possessed in this world to the fury of the flood of fire by which they were pursued. No scene of terror can be imagined equal to that which the country around on all sides presented. Naples itself, towards whose towering edifices the multiplied and large columns of flame seemed directed by the blast of the tempest, stood trembling and insecure. By nine o'clock in the evening, however, the fury of the eruption had abated, and clouds of dense black smoke alone issued from the crater, discharging heavy showers of coarse volcanic sand, first over Portici and Naples, and when the wind changed over Bosco Reale and Gioacchinopoli; in all which places, it was found in deep strata spread over the ground where the scoriæ and pumice-stones had previously been observed in similar stratified arrangements.

The author next gives an account of several concomitant circumstances, many of which are new, particularly his observations on the accumulation of electrical matter during every eruption. The advantages to be derived from this minute accuracy, which distinguishes the present writer from all others on this subject, will be felt by future naturalists, who should be inclined to throw out some fresh conjectures respecting the causes, the formation, and effects of volcanoes.

For three days after the last eruption there was no possibility of ascending the cone on account of the volumes of smoke by which it was enveloped, and the strong smell of muriatic vapours. The ascent, however, was at last effected by the author and his guides, when the immediate effect, and the products of the eruptions were properly observed, and several of the latter collected. The heat was every where scorching, and particularly annoying to the feet. The muriatic smell became more and more intense, the nearer they approached any of the openings. At intervals the surface of the cone seemed as if pierced with holes of a small size

emitting smoke, and therefore called *fumarole*. Large solid masses formed by the conglomeration of porous lava, pumice-stones, and scoriæ, held firmly together by some tenacious substance, were found in various places. The ground was thickly strewed with saline sublimations of various colours with perfectly crystallized modifications. On descending they perceived, laying on the plain, huge stones that had been ejected during the eruption, but which could not have been in a state either of fusion or softness, since in falling some of them had been broken into several minute fragments, with rugged and angular fractures, presenting nothing in their appearance, either of rotundity, or of the figure of the spot on which they had fallen, that could authorize the observer to believe them to have been originally soft bodies.

The next occupation of Signor Monticelli was that of examining the specimens of the volcanic products he had collected. Some that were deliquescent, the red and yellow coloured sublimations in particular, furnished, on the third day, a reddish yellow liquid which stained the paper and the skin. When the deliquescence of these saline substances took place on the hard lava in which they had been deposited, the latter gradually became soft, so as to assume the figure of a vase in which they had been placed to obtain the liquid in question.

This liquid was analysed by Professor Conti of Rome. It had an astringent taste, with an acid flavour, and muriatic smell: it reddened litmus paper, and possessed an oily fluidity. It appeared to be composed of

Muriate of iron -	20
Alumina - -	10
Lime - -	6.14
Free muriate acid -	9.97
Water - - -	53.89
	100

The volcano never ceased, from the end of December 1813 till the month of March, 1814, occasionally to throw up stones, smoke, and flames. In April the author revisited the mountain, its openings, and the *fumarole*; and was not a little

surprised to find, that a smell of sulphurous acid gas, deeply affecting the fauces, had succeeded to that of muriatic acid, and that instead of the muriatic salts, those openings, and fumarole still remaining, were thickly lined with sulphur and sulphate of lime. The lava of a particular part of the mountain, which the author had shewn to an eminent mineralogist, Monsieur Menard de la Groje, and which had been considered by that gentleman as a grumous lava, was now found covered with crystallized oligistic iron; a circumstance which calls to mind the curious facts I lately had the honour of noticing, in my Report on M. Methuon's Memoir on natural crystallization. The lava in question, it was ascertained, had been ejected on the 9th of October.

The last phenomenon described by Signor Monticelli, to which I wish to call attention, is the singular shower of hot sand and rain, which fell on the 9th and the 24th of May, 1814; and which, the author observes, was fatal to vegetation wherever it fell, either on account of its heat, or perhaps, from its particular nature. Sir William Hamilton had before made the same observation, as may be seen in his admirable description of the volcanic eruptions of 1779.

The Memoir of Signor Monticelli is followed by a descriptive list of volcanic productions ejected on the 25th of December, among which the sulphates and muriates of soda, the supersulphate of alumina, the salts of iron, the varieties of crystallized sulphur: together with crystals of pyroxene and amphygene; with obsidian and the specular iron ores, form some of the most prominent and interesting specimens.

To conclude, I feel no hesitation in saying, that Signor Monticelli, in thus accurately and minutely describing the effects of one of the most remarkable phenomena, that have so long engaged the attention of naturalists, has added some further facilities towards its explanation; and has therefore deserved the gratitude of geologists, and the thanks of the Geological Society.

A. B. GRANVILLE.

Brompton, April 29th.

Art. III. *General Views of Vegetable Nature. From the French, of* C. F. Brisseau Mirbel, *Member of the Institute of France. Paris,* 1815.

The following Summary of the General Phænomena of Vegetation, appears to us to constitute the best Lecture on the subject that has yet appeared.

We propose in this place to call your attention to the following points. The law which apportions the distribution of the different tribes of vegetables over the face of our globe; the influence which climate, elevation, aspect, and soil have upon beings of this nature; and the effect which plants, in their turn, produce on the exterior bed of soil, the temperature from latitude or position, as well as the general constitution of the atmosphere. Each of these points will be passed in rapid view. Were it even our intention to go far into the subjects, they must presently grow too vast for the time we could afford to them; while on the other hand, our progress would be impeded by numberless difficulties; for naturalists are yet very far from having collected the facts requisite to estimate, with any thing like precision, the part allotted to vegetables in the system of the earth.

Multitudes of different species of plants are found spread over the whole surface of the globe; like animals, these are endowed with the faculty of encreasing their races to infinity; and differ from each other as much by their interior structure as external appearance; they have each its peculiar wants, and, if we may be allowed the terms, its separate habits and instinct.

We see that some species belong to the mountains, others to the vallies, and others to the plains; some affect a clayey soil, some a chalky one, others one of a quartzose nature, while many will thrive in no place but where the soil is impregnated with soda and muriatic salt. There are some that confine themselves entirely to water; dividing themselves again into those of the marsh, the lake, the river, and

the ocean. Some require the hottest climates; others delight in mild and temperate ones; others thrive no where but in the midst of ice and frost. A large proportion must have a constantly humid atmosphere; several do very well in a dry air; but the major part are equally averse to the extremes of both dryness and moisture. There are those which flourish when exposed to the action of a strong light, while others prefer the weaker action of that element. The result of this variety of wants, is, that nearly the whole surface of the earth is occupied by vegetation.

Excess of heat, cold, or drought, a total privation of air or light, are the only bars to vegetation; and yet we find some agamous species (such as are presumed to propagate themselves without the intervention of the organs of fructification) which grow in caverns where the light has never gained admission.

Seeing that the forms of vegetables are infinitely various, and that certain species, genera, and even tribes, are attached exclusively to particular countries; and that this distribution of races, a consequence of the first order of creation, has maintained itself to our day by the effect of climate and situation, without perceptible deviation, it must be admitted that the soil takes one of its distinctive features from the vegetation it bears.

Some species are confined to the narrowest limits. The *Origanum Tournefortii*, discovered by Tournefort in 1700, in the little island of Amorgos, upon one rock only, was found eighty years afterwards by Sibthorp, on the same island, and upon the same rock; but no one has ever observed it any where else. Two of the *Orchideæ*, *Disa longicornis*, and *Cymbidium tabulare*, grow upon the Table Mountain at the Cape of Good Hope; and Thunberg, who has described them, found them on no other spot.

Mountainous countries afford many of these local species; such as dwell secluded on the heights, without ever migrating to the plains below. Thus we find that the Pyrenees, the Alps, the Appennines, &c., have their peculiar Floras, and that even some separate mountains of those great chains have

species allotted to them alone, and which are not to be found on the adjoining summits.

Speculatively we might presume that all the individuals of one species would establish themselves under the same or nearly the same degrees of latitude, as they would find a nearly similar climate. But in reality, some species extend themselves in the direction of the longitude, and never swerve to the right or to the left. This is one of those anomalies of which it is not easy to trace the cause. The *Phalangium bicolor* begins to shew itself in the country round Algiers; it crosses over to Spain, clears the Pyrenees, and terminates its career in Brittany. *Menziesia polifolia* belongs to Portugal, France, and Ireland. The heaths are confined exclusively to Europe and Africa; they extend themselves from the regions bordering on the Pole to the Cape of Good Hope, over a surface which is very narrow in proportion to its breadth. The *Ramonda pyrenaica*, as yet only found in the Pyrenees, follows, without deviating from its course, the vallies in those mountains which run from north to south, and so closely, that not a single plant of it has been described in those which skirt the chain in the other direction. But we will now quit insulated facts, and turn our attention to vegetation in general.

It may be observed, that with the exception of the Lichens, which bid defiance to all climates alike, that a vastly greater proportion of species is calculated to endure a very high degree of warmth, than is calculated to bear severe cold. The progressive course of the proportion demonstrates itself most clearly if we direct our view from the polar, towards the equinoctial regions. Botanists compute that at Spitzberg, which lies near the 80th degree of northern latitude, there are only about 30 species; in Lapland, which lies in the 70th degree, about 534; in Iceland, in the 65th degree, about 553; in Sweden, which reaches from the southern parts of Lapland to the 55th degree, 1300; in Brandenburgh, between the 52d and 54th degree, 2000; in Piedmont, between the 43d and 46th degree, 2800; nearly 4000 in Jamaica, which is between the 17th and 19th degree; in Madagascar, situated between the 13th and 24th degree under the tropic of Capricorn,

more than 5000. But such computations are very wide of the true proportion of species which belong to hot climates, as opposed in that respect to cold or temperate climates. To come at the real amount of the difference, we must first know the number of species spread over the whole globe; how many belong to the same space under the same longitudes at different latitudes: how many are common to several countries at the same time; how many belong exclusively to peculiar regions. Points, that will require the lapse of ages for the Botanist to enable himself to resolve.

The general face of the vegetation of a country does not depend solely upon the number, it depends also upon the more or less remarkable characters of the species found there. The chief part of these characters, are fixed; and are derived, as I have said before, from primitive creation, not from the effect of climate. As to the proposition, that certain vegetable forms are necessarily coexistent and dependent upon certain other animal forms in a given climate, (an occult law of nature of which some ingenious writers have endeavoured to find the proof in those harmonies and contrasts which always result from the approximation of different beings,) we do not presume to controvert it; but sound reasoning rejects its adoption, as a doctrine, while the connection and reciprocal control of the phenomena of nature are unknown to us. Cautious and exact observers of those things which are the objects of our senses, let us leave to the fancy of the poet the bold task of unfolding the purposes of the Creator in his works; while we confine ourselves to the less presumptuous one of describing them as we find them.

Vegetation within the tropics fills the European traveller with amazement, by the majesty and vigour of its aspect. The proportion of the woody to the herbaceous species, is vastly more considerable towards the Equator than in Europe; and the difference is therefore in favour of the equinoctial regions, for trees give the character of grandeur to vegetation. Those of the dicotyledonous class within the tropics, are frequently conspicuous for the height and circumference of their stems, the richness and variety of their foliage, as well as the

bright and well contrasted colours of their blossom. By the irregularity of their forms, they set off to advantage the arborescent monocotyledons of the Palm tribe, which have in general the simple sober forms of our columns, of which they were the models. It is towards the Equator, that the gigantic climbers, which grow to the length of several hundred yards are found; as well as those magnificent herbs of the *Scitamineæ* and *Musæ*, as tall as the trees of our orchards; with flowers and foliage not less pre-eminent in their dimensions. For instance, the *Corypha umbraculifera*, an East Indian palm, with leaves in the form of an umbrella and more than six yards across; and the *Aristolochia*, that grows on the river of La Madalena, the flowers of which, according to M. de Humboldt, serve the children for hats. The far greater part of the aromatic plants, belong also to the equatorial regions.

By the side of this rich and varied vegetation, that of Europe appears poor and tame. Here the species of trees are few; and all have a port and foliage in which much sameness prevails. Their flowers make so little shew, that the generality of people, who think nothing the flower except the corolla, being ignorant of the use and importance of the other parts, believe that most trees have none at all.

The inferiority of the vegetation of our regions will appear in a still stronger light, if we compare the species of the same genera or tribes which grow both in Europe and under the line. In South America, plants of the fern-tribe, with a foliage and fructification not very unlike our common Brake and Polypody, grow like palms, and have a stalk in the form of a column.

The cold and temperate climates of our quarter of the world abound in dwarf herbaceous tufty *Gramineæ;* hot countries have also many plants of this tribe, but they are on a much larger scale. This difference begins to be perceived even when we reach Italy, where the millet attains the height of 4 or 5 yards. The bamboos, panic-grasses, and the sugar-cane of Asia, Africa, and America reach the height of 8 or 9 yards.

They say that in parts of the East Indies there are antiquated bamboos, which are real trees, with a haulm of such girth that a piece divided length-ways makes two entire canoes.

The herbaceous monocotyledons of the tropics, such as the *Liliaceæ*, are greatly superior to ours in the beauty of their flowers.

The heaths of the northern parts of Europe are low bushes, with feeble stems and small bloom; those of the coasts of the Mediterranean have also a small bloom, but their stems are taller and more robust; those of the Cape fascinate by the form, splendour of colour, and size of the corolla.

The *Geraniums* of Europe do not approach those of Africa in point of stature or beauty of flower.

All the plants of the mallow-tribe with us are herbaceous; those of hot climates, either shrubs or trees. A tribe, of so little account in these parts, holds a place among the vegetables of the most note in the equinoctial regions. There it counts among its species the *Baobab* and the *Ceiba*, the colosses of the vegetable creation; besides the "hand-tree" of Mexico, so called from the form and disposition of the stamens of the flower, which represent very tolerably a hand or paw with five fingers.

The *Leguminosæ* or pulse-tribe furnish Europe with many herbaceous species, several shrubs, and one middle-sized tree; all of which, however, have leaves composed of but few leaflets. The same tribe in the hot climates of Asia, Africa, and America teems with lofty trees, graced with leaves of the most delicate texture, divided and subdivided into numberless leaflets, and playing in the wind like plumes.

The *Aroideæ* in Europe never exceed the height of a yard; those of Mexico, the Brazils, and Peru sometimes tower into the air like the Banana, of which they assume the appearance; at others lengthening themselves into supple climbers, they mount to the tops of the highest trees.

Differences as strongly marked are exemplified in the *Orchideæ*. In Europe the species are low; their flowers, although equally interesting to the botanist by the singu-

larity of their structure as in other regions, are too insignificant to attract the attention of any who do not make plants an object of their study. In the torrid zone, the case is quite different in regard to this tribe; the greater portion of which consists of species that excite our wonder by the size and brilliancy of their blossom; and many, as the Vanilla, suspend their long branches covered with a foliage of shining green and terminated by magnificent garlands of flowers from the summits of trees.

The *Apocyneæ*, *Boragineæ*, *Convolvulaceæ* and many other tribes, are equally examples of contrasts of a like nature. The European naturalist, whom the ardent thirst of science leads under the Equator, views with extacy those fertile regions, which exhibit at every step forms familiar to him, decked in the rich attire bestowed from the hand of a more bountiful and powerful nature.

There are beauties in a land yet wild and savage, which disappear at the approach of civilization. In Europe the soil abounds only in plants which are of use to man. Domestic vegetables, by the aid and protection of the cultivator, have so trenched upon the domain of the wilderness, that space is scarcely left for the existence of those for which man has no call. The primeval forests of the Gauls and Germans have disappeared. Forests at this time of day are mere formal plantations of large extent. They are intersected in all directions by roads and paths, are explored without difficulty; and the wild animals no longer find safe refuge in them. Generations of trees are renewed in quick succession, on a soil which the industry of the proprietor keeps in constant requisition, and it is mere chance, when a single stick is left to end its career by old age. Far in the north there are several forests which still preserve some traces of the primeval vegetation of Europe. In these the oaks, spared by the axe, acquire an enormous size; while others worn out by age, fall of themselves, are decomposed, and help unceasingly to augment the surface of the soil covered with high mosses and thick lichens, that preserve a prolific moisture.

None however approach in magnificence the forests which

shade the equinoctial regions of Africa and America. One is never satiated in admiring there the endless multitude of vegetables brought into near contact with each other, and mingled promiscuously together; so different among themselves, and often so extraordinary in structure and produce; those enormous trees still exhibiting no symptoms of decay, though their age goes back to a period at but little distance from the last revolution of our globe; those towering palms, contrasting by their simple forms with all that surrounds them; those extensive climbers; those ratans which, knitting together their long and flexible branches by numberless knots and turns, encircle as one group the whole vegetation of these extensive regions. To clear a path through these, neither fire or axe are sufficient; the one extinguishes for want of circulation in the air, the other is broken or blunted by the hardness of the wood it meets. The soil cannot afford place to the numberless germs which it developes. Each tree disputes with others, which press from all sides, the soil it wants for its existence; the strong stifle the weak; while rising generations obliterate even the slightest trace of destruction and death; vegetation never flags; and the earth, so far from becoming exhausted, acquires new fertility from day to day. Hosts of animals of every kind, insects, birds, quadrupeds, reptiles, beings as diversified and strange as the vegetation of the place itself, retire themselves under the vast canopy of these ancient thickets as into a citadel proof against the attack of man.

North America, under the same degrees of latitude as France and England, and with a colder climate, presents a far richer vegetation. There large trees such as the *Liriodendron* and *Magnolia* bear the most superb flowers. Those of many other trees and shrubs vie in beauty with the flowers of the torrid zone; the light waving composite foliage of the *Robinias* and *Gleditschias* are the counterparts of the *Mimosas* of the tropics. The single genus of oak comprehends within the United States more species than Europe reckons within the whole amount of its trees.

In the northern parts of Asia vegetation differs but slightly

from that of our own country. We meet with nearly the same genera, and similar types prevail. But in the southern parts the character of the country is changed. Without water, and swept by scorching winds, the drought is extreme. The carpet of soft verdure and the refreshing shade of its northern countries and of Europe are looked for in vain. Most of the plants have thinly scattered long narrow arid leaves, unscalloped and entire at the edge, and of a gloomy green; several have none at all, or at least such, as instead of leaves may be truly termed thorns. Yet many of the trees and shrubs have a shewy blossom. Of the former, the largest in those parts belong to the myrtle tribe, and have a punctured foliage, diffusing an aromatic scent when bruised. There are likewise many shrubs of the pulse-tribe with a composite foliage; but the leaflets of the leaves are only evolved on the plant's first rising from the seed. As it advances to maturity, the naked footstalks widen into simple lanceolate blades, or become transformed into acicular spines, resembling the leaves of some of the *Asparagi*. In New Holland the *Proteaceæ* abound; so they do at the Cape of Good Hope; but the *Liliaceæ*, which decorate the African promontory so profusely, are, on the contrary, rare in New Holland. It is a fact as notorious as surprising, that no one vegetable belonging to the countries towards the southern pole produce a single fruit for the food of man.

There are divers conditions without the performance of which the growth of the different species cannot proceed. An uninterrupted heat is requisite for some; a moment's decrease in it is fatal to them; some withstand a considerable degree of cold while their sap is quiescent, but want a high degree of heat when that is once in motion; some like a moderate temperature, and dread equally the excess of both heat and cold. It is upon the observation of such appearances that the cultivator grounds his practice; he knows that it would be in vain for him to attempt to grow, without shelter, either the date or orange beyond the 43d degree of northern latitude; that the olive will do a little beyond; that the vine is barren beyond the latitude of 50 degrees, or at least never brings

its grape to perfection. He is cautious of exposing in a southern aspect, the species whose sap is readily set in motion by the first gleam of warmth; he knows that late frosts destroy them; witness! the vineyards round Paris: the plantations there which escape the injuries of frost, are not those which look towards the south, but those that look towards the north. The sap of the latter is set in motion late, and when the heat reaches them, the season is already settled, and no risk is run from the inroad of cold.

Late frosts are peculiarly hurtful to the delicate American and Botany Bay plants, which we are attempting to naturalize in Europe. Many of these will bear a very sharp cold in the heart of winter; but no sooner does the spring advance, and a softer air prevail, than their roots begin to elaborate their juices under ground, their bark to fill with moisture, their buds to swell and open, and a fall in the temperature if but for one moment, destroys them.

Local circumstances, such as the elevation of the place, its aspect, the nature as well as dipping of its soil, the proximity of mountains, of forests, of the sea, &c., &c., are all causes of variation of temperature, and must each be attended to, in accounting for the vegetation of any particular district.

For instance, the winter is less severe on the northern coasts of France, than in the interior on the same level; an effect of the vicinity of the ocean. The sea preserves a far more even temperature than the atmosphere, and is constantly at work to maintain some degree of equilibrium in the warmth of the air. In the summer, it carries off a part of the caloric from it; in the winter, it gives back a part of that which it contains. It is thus that the mass of water held in the vast basin of the ocean, tempers on its coasts the heat of summer, and the cold of winter. For this reason, on the coasts of Calvados the myrtle, Fuchsia, magnolia, pomegranate, indian rose, and a swarm of other exotic plants, grow in the open air, but in the department of the Seine require shelter. The same cause permits the cultivation of many species in the open ground about London, that near Paris will not do without a green-house.

Local circumstances however have only a limited influence, and it may be laid down as a general principle, that the cold in the same or nearly the same longitudes is, during winter, in direct proportion to the distance from the Equator. We say during winter, because the length of the days in the summer of the polar regions, sometimes renders the heat even more intense than in our climates: and it is very probable that many of the herbaceous plants of the tropics would succeed in Sweden, Norway, Lapland, and even at Spitzberg, if the frost did not set in too early to admit of their completing the round of the vegetable career.

In proportion as we advance towards the Pole, we are sensible of the change in the appearance of the vegetation. The species which require a mild and temperate climate, are supplanted by others which delight in cold. The forests fill with pines, firs, and birches, the natural decoration of a northern land. The birch, of all trees, is the one that bears the severity of the climate the longest; but the nearer it approaches the Pole, the smaller it grows; its trunk dwindles and becomes stunted and the branches knotty, till at last it ceases to grow at all towards the 70th degree of latitude, the point where man gives up the cultivation of corn. Further on, shrubs, bushes, and herbaceous plants, only are to be met with. Wild thyme, daphnes, creeping willows, and brambles, cover the face of the rocks. It is in these cold regions that the berries of the *Rubus arcticus* acquire their delicious flavour and perfume. Shrubs disappear in their turn. They are succeeded by low herbs, furnished with leaves at the root, from the midst of which rises a short stalk surmounted by small flowers. Such are the saxifrages, the primroses, the *Androsaces*, *Aretias*, &c., &c. These pretty plants take up their quarters in the clefts of rocks, while the grasses with their numerous slender leaves spread themselves over the soil, which they cover as with a rich verdant carpet. The lichen, which feeds the rein-deer, sometimes mixes in the turf: sometimes of itself covers vast tracts of country: its white tufts standing in clumps of various forms, looking like hillocks of snow which the sun has not yet

dissolved.. If we go farther, a naked land, sterile soil, rocks, and eternal snows, are all we find. The last vestiges of vegetation are some pulverulent *byssi*, and some crustaceous lichens, which cover the rocks in motley patches.

The principal causes which induce this progression of changes are three: 1st, the excess of duration in the winters, a consequence of the obliquity and disappearance of the solar rays; 2d, the dryness of the air, a consequence of the decrease of heat; 3d, the prolonged action of the light, which illumines the horizon through the whole period of vegetation. I will resume, in as few words as I can, the effects of each of these three causes.

It is well known that too great a degree of cold, by congealing the sap, occasions the rupture of the vascular system in plants, and thereby destroys them; but the deleterious action of cold is not confined to purely mechanical results; it has been proved that heat is a stimulus that cannot be dispensed with in vegetation. Many species secrete juices in warmer regions which are unknown in their œconomy in colder climates. The ash yields manna in Calabria, but loses that faculty as it advances towards the north. The grape in the south of Europe abounds in matter of a sweet quality; in the north, it contains an excess of acid. So long as the organic functions, which depend upon the degree or duration of heat, can be carried on, the ash and the vine continue to grow; they grow even when those functions are performed incompletely; but their growth is stinted. They finally disappear at that point where the portion of warmth in the atmosphere, though still equal to prevent the freezing of the sap, is no longer able to stimulate their organs or their frame into action. All other vegetables, whose dimension and duration subject them to the full severity of the frost, share the same destiny at a greater or less distance from the torrid zone, and in proportion as their constitutions require a greater or less degree of heat. So that nothing is found near the Pole but such dwarf shrubs as are sheltered under the snow in winter, or annuals and herbaceous species, endowed with so quick a principle of life, as to rise,

flower, and fruit within the space of three months; or some agamous and cryptogamous species, which adapt themselves to all degrees of temperature, and are consequently the last organic forms under which vegetable life is to be described.

Heat and moisture united are highly favourable to the growth of plants. No countries are more abundant in herbaceous vegetables or better wooded than Senegal, Guinea, and Cayenne, where both these props of vegetation are in the plenitude of their force. Experiments made with the hygrometer prove that the moisture of the atmosphere increases as we approach the Equator. In hot climates, when the sun sinks below the horizon, the watery exhalations condensed, are returned to the earth in the form of dew, that moistens the surface of the foliage, and feeds those vegetables in which the absorbing powers of the parts above ground suffice for their support. Of this number are the succulent plants; the *Aloes*, the *Cacti*, the *Mesembryanthemums*, some of the Spurges, &c. In these, the fibrous root only serves to hold them in their places; and the moisture of the atmosphere is inhaled and retained by the spongy parts above. Thus in the vast plains that receive the waters from the eastern declivity of the Andés, when the scorching heat of summer has consumed the grasses and other herbaceous kinds which the rainy season had brought forth, we still find some lingering *Cacti*, which, under their dry, thorny coats, conceal a cellular system, by which an abundant sap has been imbibed and preserved. But in countries where the atmosphere holds but little moisture in evaporation, either because the soil is wholly destitute of water, or by reason of the coldness of the temperature, we find no plants at all, or such only as are of dry, hard texture. The sands of Africa, watered by no river, are found to be utterly barren. Spitzberg, Nova-Zembla, Kamschatka, &c. where the influence of the sun is only felt for two months in the year at most, and where, consequently, the air is habitually dry, furnish a very scanty portion of herbaceous plants only, or some dwarf shrubs, with a narrow leathery foliage. It is true that drought is not in these instances the sole cause of the degenerated state of

vegetation, but it would of itself be sufficient to produce it: for it is a fact, that plants acquire height of stem and breadth of foliage only in proportion to the abundance of nutriment which they meet with in the atmosphere, and that nutriment is water reduced into vapour, and held in suspension by the atmosphere.

When vegetables are deprived of light, they extend in length, shoot up pale, lank stalks, are of a lax fibre, and of no substance; in short, they spindle themselves out. The way that light acts upon this class of the creation, is principally in separating the elementary parts of the water and carbonic acid contained in them, and in extricating the oxygen of the latter. The carbon of the acid, with the hydrogen and oxygen of the water, form the bases of the gums, resins, and oils, which flow in the vessels or fill the cells. These juices nourish the membranes, and induce the woody state in them; and they do this in proportion as the light is stronger and its action more prolonged. Thus we see that darkness and light have effects directly opposite upon vegetables. Darkness favours the length of their growth by keeping up the pliancy of their parts; light consolidates them, and stops growth by favouring nutrition. It should follow that a fine race of vegetables, one that unites in due proportion, size, and strength, depends in part upon the proper reciprocation of nights and days. Now in the northernmost regions, plants go through all the stages of growth at a time when the sun no longer quits the horizon; and the light, of which they experience the unremitting effect, hardens them before they have time to lengthen. So their growth is quick, but of short duration; they are robust, but undersized.

The same plants, when transplanted into milder regions, where the atmosphere is moist, and light and darkness follow in regular succession; if they are but endowed with a frame of sufficient pliancy to support their new mode of existence, are seen to lengthen their stems, expand their branches, as well as multiply, dilate, and soften their leaves.

Vegetation, in ascending above the level of the sea, undergoes modifications analogous to those which attend its pro-

gress from the line to either pole. With this distinction, that in the last case the phenomena succeed by almost imperceptible gradations, while they crowd upon and follow each other in rapid succession on the ascent of mountains. The height of 4 or 5000 yards in the hottest parts of the globe, produces changes as distinct as the 2000 leagues or more, which lie between the Equator and the polar regions. The three causes of the influence of which we have just spoken, all re-appear within this space; *viz.* a diminution of heat; dryness of air; and protracted duration of light. To these we must add two others; a decrease of depth in the volume of the air, and a scarcity of those substances which abound in carbon, and are produced by the decomposition of organic bodies.

The higher we ascend the shallower the upper stratum of air becomes; thence the excessive cold at great heights; for it is the action of the atmosphere upon the rays of light which extracts the caloric from them, and we know that the extraction of caloric diminishes in proportion as the mass of air traversed by the rays is shallower; but on the other hand, the light is purer and more active, just as if caloric was really a simple transmutation of light, as some naturalists have conceived it to be.

The weight of the atmosphere, which at the level of the sea supports a column of mercury 28 inches high, diminishes as we ascend; so that at the elevation of 6000 yards it will only support a column of 13 inches and some lines high. A consequence of this fact is, that the vaporisation of fluids takes place on high mountains at a very low degree of heat. Notwithstanding this, however, the decrease of heat is so great that the ambient air is very slightly impregnated with moisture.

It is true that heights have not the long days of the polar regions; but they receive the rays of the sun earlier than the plains, and are quitted later by them, so that their nights are shorter than in levels.

In fine, substances containing carbon, the wrecks of organized bodies, are rare on mountains, the rains as well as the

waters of the springs, dissolving them and carrying them away as they run off into the vallies.

It cannot be doubted, but that these causes united must act powerfully upon vegetation. The slightest degree of heat will cause the plants on mountains to transpire copiously; the severity of the cold, the dryness of the atmosphere, the shortness of the nights, the scarcity of carbon, will impede the enlargement of their leaves, and the growth of their stems; the strength of the light and the protracted duration of the days will accelerate the induration of all the parts of their frame.

The courses of vegetation on mountains had not escaped the penetration of Tournefort. At the foot of Mount Ararat he had observed the plants which grow in Armenia; a little higher, those of Italy and France: above, those of Sweden; and upon the summits those of Lapland. Observations of the same kind had been subsequently made on Mount Caucasus, the Alps, the Pyrenees, and other mountains of the old continent. Every botanist had learned that many of the Alpine plants, that is to say, plants which grow on the various high lands of Europe and Asia, are likewise met with at Spitzberg, in Nova Zembla, Lapland, and Kamschatka. Swartz had discovered on the mountains of Jamaica, under a still hotter sky, if not plants exactly of the same species with those of our Alpine phænogamous ones, at least some that were analogous to them; and a great many of the cryptogamous species precisely the same as our own: for example, *Funaria hygrometrica*, the *Bryums serpyllifolium* and *cespititium*, *Sphagnum palustre*, *Dicranium glaucum*, &c. Linnæus in his own way had summed up these facts in an axiom. "The different kinds of plants," says he, "shew by their stations the perpendicular height of the earth." Yet it was not till lately that any exact survey had been taken of this interesting department of botanical geography.

The first connected series of researches made with the direct intention of ascertaining the progressive succession of plants on mountains, was instituted by M. Ramond. That learned person devoted ten years to the investigating the entire chain

of the Pyrenean Mountains; and studied it not only as a geometrician, natural philosopher, and mineralogist, but also as one of the most skilful of botanists; he discovered, with the sagacity that distinguishes him, the stations to which the different species of vegetables belong, and the special circumstances which sometimes cause a derangement in the natural order of their succession. We shall here shortly point out some of the results of his observations.

The common oak (*Quercus robur*) grows in the plains, on a level with the sea; reaches the slopes of the mountains, and ascends to the height of 1600 yards. It degenerates in proportion as it approaches the point where it ceases to vegetate.

The beech (*Fagus sylvatica*) makes its first appearance at the height of 600 yards above the sea, and its last at 200 yards above the oak. The silver-fir (*Pinus picea*), and the yew (*Taxus communis*), shew themselves at 1400 yards, and go on to about 2000. The Scotch fir (*Pinus sylvestris*) and the Mugho pine (*Pinus pumilio*) take their stations between the heights of 2000 and 2400 yards.

There the trees stop, and shrubs with a juiceless foliage and low or creeping stems present themselves; these lie hid beneath the snow in the winter. Among them are some of the *Rhododendrums*, *Daphnes*, *Passerinas*, the *Globularia repens*, the two species of *Salix*, *herbacea* and *reticulata*, &c.

Soon after we meet only small herbs with perennial roots, a foliage disposed in a rosette and a naked stalk. These, with the lichens and *Byssi* arrive at the height of 3000 and even 3400 yards. The first that occur are the *Gentiana campestris*, *Primula villosa*, *Saxifraga*, *longifolia* and *Aizoon*, &c.; then *Ranunculus alpestris*, *nivalis*, *parnassifolius*, *Aretia alpina*, and finally *Ranunculus glacialis*, *Saxifraga cespitosa*, *oppositifolia*, *androsacea*, and *groenlandica*. The last bring us to the borders of eternal snow.

Botanists who have explored the Alps have remarked phenomena perfectly corresponding with those observed by M. Ramond in the Pyrenees. But it was reserved for Messrs. Humboldt and Bonpland to demonstrate the succession of

modifications in the vegetable structure on the highest mountains yet known, and in one of the hottest and most fertile regions of our globe.

In the equinoctial countries of America vegetation displays itself to the view of the observer as on the gradually rising steps of an immense amphitheatre, the base of which sinks below the waters of the ocean, while its summit reaches to the foot of the glaciers which crown the Andes, 5000 yards above the level of the sea. Shewing that in America there are vegetables which grow at the height of 1600 or 1800 yards beyond the point where vegetation ceases in the Pyrenees and Alps; a difference that does not depend solely upon latitude, but likewise, according to M. Ramond, upon the breadth, or if you will, the thickness of the chain of mountains. In chains of but little breadth, such as those of Europe, the air and temperature of the plains have an influence, which is constantly tending to confound the limits of the different kinds of vegetables; but this is not the case in the chain of the Andes, which is from 48 to 60 leagues in breadth. Messieurs Humboldt and Bonpland have had also this advantage in their researches, that as these were made under the Equator, they have been enabled to trace the whole series of modifications which are to be met with between the two extremes of temperature found at the surface of the globe; while other botanists, having explored none but the northern mountains of the old continent, could only trace the modifications between a mean temperature and extreme cold.

The plants which belong to dark and humid abodes, such as *Boletus ceratophorus* and *botrytes*, *Lichen verticillatus*, *Gymnoderma sinuata*, and *Byssus speciosa*, are found on the vaults of caverns and the wood-work of mines, as well in Mexico as in Germany, England, and Italy. Concealed within the bowels of the earth, these less perfect species constitute the last zone of vegetation.

Next come the plants which belong to fresh water and salt water. Of these, a great portion grow without preference in every degree of latitude, the medium in which they exist preserving a more equable temperature than the atmos-

phere. Duck-weed (*Lemna minor*) and the Greater Reed-mace or Cat's tail (*Typha latifolia*) grow in the marshes both of Asia, Europe, and America. The *Typha latifolia* belongs in common to Jamaica, China, and Bengal. Probably there is no region on the globe where the Gray Bog-moss (*Sphagnum palustre*) is not to be found. This indifference to climate is still more remarkable in the sea-plants, such as the *Fuci*, Lavers, and *Ceramia*. The Gulf-weed, (*Fucus natans*) detaching itself from the rocks on which it grew, and forming shoals of an immense extent at the surface of the water, obstructs the way of the ship as well towards the poles as under the line. On a level with the sea to the height of 1000 yards, we find the palms, the liliaceous plants, the plantain trees, the *Scitaminiæ*, the genera *Theophrasta*, *Mussænda*, *Plumeria*, *Cæsalpinia*, *Hymenæa*, the *Cecropia peltata*, the balsam of Tolu, the Cusparé or Cinchona of Carony, with crowds of other species which grow only in a very hot temperature. This is the zone of the palms; a tribe conspicuous for the elegance and grandeur of port of its species, and forming one of the chief ornaments of the scorching plains that lie between the Tropics. Some of them thrive, however, in more temperate regions. The *Ceroxylon andicola*, a fine palm rising 60 yards in height, grows in the Andes at Tolima and Quindiu, in the 4° 25′ of northern latitude, setting off at 1860 yards above the sea, and continuing to the height of 2870, an elevation where the atmosphere is at a moderate degree of warmth. Another species has been discovered at the streights of Magellan, towards the 53° of southern latitude. Two sorts, the fan-palm (*Chamærops humilis*) and date-tree, are even seen to grow on our side of Europe, upon the coasts of the Mediterranean, and not far from the foot of the Pyrenees, thus advancing their tribe to beneath the 43d degree of northern latitude. But these are the exceptions; the palms in general confining themselves to the hottest parts of the globe, and none being met with towards the polar regions.

The zone of the arborescent ferns and the cinchonas succeeds to that of the palms and *Scitamineæ*. The ferns begin at 400 yards, and end at 1600. The cinchonas go on to about 2900

yards high. The oaks begin to appear at 1700 yards. These are deciduous, and by their periodical evolutions from the bud remind the European, while wandering in these distant regions, of the mild springs of his native land.

Trees cease to grow at the elevation of 3500 yards, where the shrubs, which before had formed but a small part of the vegetation, take their place and cover the whole soil.

A good deal lower, at about 2000 yards, the Gentians, *Lobelias*, Crowfoots or Ranunculuses, &c., which answer to our alpine plants, had already begun to shew themselves; and keep on from thence to 4100 yards.

At this point where snow occasionally falls, the grasses, whose numerous species were mingled in the vegetation of the lower steps of the amphitheatre, begin to reign alone. The oat-grasses (*Avena*), bent-grasses (*Agrostis*), cocks-foot-grasses (*Dactylis*) panic-grasses (*Panicum*), feather-grasses (*Stipa*), *Jarava*, &c., here cover the face of the mountains and continue their career up to 4600 yards, the point at which phænogamous vegetation ceases.

From thence to the regions of perpetual snow, nothing grows except *Byssi*, *Hypoxylums*, and liverworts or lichens. So that both the base and summit of this immene amphitheatre are occupied by plants the lowest in the scale of organic perfection, while its intermediate steps are crowded with all the riches and variety of the vegetable creation.

Many of the less perfect plants grow under circumstances the most unfavourable to vegetation. Neither the total privation or the excess of light, nor the extremes of moisture or dryness, nor scorching heat or the fiercest cold, nor want of mould or scantiness of carbon, prevent these rude species from developing their forms; neither are they of small importance in the general œconomy of nature. By them the soil is prepared, and they lay the foundation of vegetation.

The rudest of the lichens, such as the *Liprarias*, the *Verrucarias*, the *Lecideas*, &c., mere coloured crusts of the simplest structure, first fix themselves on the smooth surface which they erode, break up, and scoop into hollows. These at last are turned into dust. Sorts a degree higher in the scale of

organization, such as the *Gyrophoras*, the *Cenomyces* the *Stercocolons*, &c. together with some elegantly formed mosses, resembling trees and shrubs in miniature, take their place. By the successive dissolution and regeneration of such vegetation through a long series of years, a thin stratum of mould is formed upon the stone, in which some phænogamous herbs, such as certain grasses, stone-crops, saxifrages, whitlow-grasses, worm-woods, and others with small leaves and low slender stems, sow themselves. Generations succeed each other, and the mould deepens. Herbs of higher stature, bushes, and even shrubs take their stand on the newly fertilized rock. At last, the seeds of trees themselves, carried either by animals, the water, or the wind, are seen to germinate, probably to become the first inhabitants of a forest that shall one day extend itself over vast tracts of country.

Lichens will not grow upon sands that are set in motion by the wind; but the grasses and the *Cyperaceæ*, which are nearly as unformed and rude as these, afford some turfy species with fine closely fibred roots; by these they weave themselves together and bind down the sand, which every breeze had used to drive to and fro like the surge of the sea. The soil once made stable, vegetables of every size thrive in it. Hence the industrious inhabitant of Europe has been taught, to use the sea lyme-grass (*Elymus arenarius*), and others of the same nature, to fix the sand of those beaches which threaten to encroach on his fields near the shores of the sea.

The bottoms of the marsh and lake are gradually though slowly raised by aquatic plants, such as the water-milfoils, horse-tails, pond-weeds, water-lilies, reed-maces, duck-weeds, bog-mosses, confervas, &c. The water gaining in surface what it loses in depth, is sometimes made to overflow at one side or the other; and even to disappear entirely, when the springs which feed it are no longer able to counterbalance the waste from evaporation, which every one knows encreases with the surface.

It sometimes happens that certain species, especially of the bog-moss, float themselves on marshes and lakes, forming

islets and small peninsulas, which are encreased from day to day both in extent and depth from the accumulated wreck, and remains of the plants which have grown on them. This factitious soil is sometimes clothed by meadows, sometimes by shrubs, and even trees; when now and then it breaks under the weight of the load, and sinks to the bottom of the water These appearances are by no means uncommon in Prussia, Lithuania, and other parts in the north. The effect they have in changing the face of the soil is greater or less according to circumstances, and in certain districts they may even affect perceptibly the temperature and quality of the atmosphere; but scarcely beyond the spot where they take place. In regard to forests, however, the case is very different; their influence is felt far around. Their usual effect is to cool the atmosphere, to a greater extent even than the degree of latitude. When France and Germany were covered with wood, Europe was much colder than at present; the winters of Italy were longer; the vine could not be cultivated on this side of Grenoble; the Seine froze every year. The parts of the coast of Cayenne which have been cleared of their wood by Europeans, experience in summer in its full force the overwhelming heat of the sun of the torrid zone, while, in the same season, the interior of the country is cooled to such a degree by forests, that a fire or shelter is found necessary in order to pass the night.

The causes why forests thus lower the temperature, are plain. They detain and condense the clouds as these pass; they pour into the atmosphere volumes of water dissolved into vapour; winds do not penetrate into their recesses; the sun never warms the earth they shade; and the soil being porous, as formed in part of the decayed leaves, branches, and stems of trees, and coated over besides by a thick bed of brushwood and moss, is constantly in a state of moisture. The hollows in them serve as reservoirs for cold and stagnant waters, their declivities give rise to numberless brooks and rivulets; and, as we see, the best wooded countries are ever those which are watered by the largest rivers.

In proportion as man, who finds himself cramped in countries of long standing civilization, extends the boundaries of his domain by stripping the soil of its ancient forests, so the wind and sun disperse the superabundant moisture; the springs exhaust themselves; the lakes dry up; inundations cease altogether or confine themselves to a smaller extent; the volume of water carried along by rivers diminishes; and the atmosphere becomes warmer and drier. These are results that cannot be denied, and, without mentioning the numerous evidences which history offers, it will be sufficient to adduce the United States of America as a proof. It is a fact admitted by all, that the clearing of the woods begun two centuries ago in the European colonies, and continued unceasingly to this day, has occasioned a very evident diminution in the quantity of water, and a perceptible elevation in the temperature of the climate. But where from improvidence or brutal selfishness, man has destroyed the woods of a country without reserve, the soil, bereft of the moisture requisite to the maintenance of vegetation, has been reduced to the most fearful sterility. The Cape Verd islands, once watered by numerous springs, and covered with lofty forests and luxuriant herbage, now present to our view only waterless gullies, rocks bared of their mould, with here and there a patch of parched herbs, some stunted bushes, and a few plants of the succulent kind, such as *Cacalias*, Spurges, Aloës, Adam's needles, Fig-marygolds, *Mesembrianthemums* and *Cactuses*. The isle of France, formerly so fruitful, is at this moment threatened with the same sterility, if the wisdom of government does not hasten to set proper bounds to the improvident waste of the woods by the falls now carrying on.

In mountainous countries, above all others, the destruction of trees produces the worst effects. The forests which encircle them above, are the protection of the fields below; but when once the axe is used among them without a due discretion, the rain breaks up and carries off the layer of mould no longer consolidated by roots; large and deep gullies are cut by the descending torrents on all sides; the snow, accumulated on

the summits during winter, slides down the declivities, and finding no dam that stops it, enormous masses are precipitated with a dreadful crash to the bottom of the vallies, destroying in their way the fields with their cattle, and the villages with their inhabitants. The rock once laid bare, the rain-water which penetrates its clefts, silently undermines it; the frost cracks and crumbles it away; it falls in ruins, accumulating at the foot of the mountain mounds of rubbish. This is an evil which has no remedy; the forests once banished from highland tops are never replaced; while the washings and rubble carried down yearly by the rain, soon transform into a desart the populous and flourishing valley below.

The vegetable mould produced by herbaceous plants upon unsheltered lands is destroyed by the action of light, heat, and oxygen, while that which is formed in the shade of forests defended from the effects of these destructive agents, encreases from day to day both by the remains of vegetables, as well as of the animals of all kinds which seek refuge in them. This is the reason why newly cleared land is endowed with such prodigious fertility. In this either rye or oats must be cultivated for the first years, its too abundant richness causing the more precious wheat to grow rank, and produce little grain. But sooner or later, the soil is exhausted, and recourse must be had to manure, to restore the nutritious particles carried off by successive crops. If this is neglected, harvests begin to dwindle, briars and brambles and a thousand wild plants take the places of those which had been produced by agriculture. The flocks diminish rapidly; for the encrease of flocks, and consequently of the human race, depends above all things upon the prosperity of agriculture.

These remarks upon the nutrition of plants, lead us to address you shortly on the most prominent results produced by vegetation, and here we shall conclude.

All is connected in the vast system of the globe, and order emanates from the equipoise of conflicting phenomena. Animals carry off the oxygen of the atmosphere, replacing it by carbonic acid gas; and are thus at work to adulterate

the constitution of the air, and render it unfit for respiration. Vegetables take up acid gas, retain the carbon, and give out oxygen; and are thus purifying the air tainted by animals, and re-establishing the necessary proportions between its elements. In Europe, while our vegetables, stripped by the severity of the season of their foliage, no longer yield the air contributing to life, the salutary gas is born to us by trade-winds from the southernmost regions of America. Winds from all quarters of the world intermingle thus the various strata of the atmosphere, and keep its constitution uniform in all seasons and at all elevations. The substances which are produced by the dissolution of animal and vegetable matter, diluted with water, are absorbed by plants, and constitute a portion of the nourishment by which they are maintained; plants, in their turn, become the food of animals, and these again the prey of others which subsist on flesh. In spite of this perpetual state of war and destruction, nothing perishes, for all is regenerated. Nature has ordained that the two great divisions of organized beings should depend the one upon the other for support; and that both the life and death of individuals should be equally serviceable in keeping up the races of them.

If we come to consider vegetation as it regards ourselves, we shall find that this great agent of nature, subjected in a certain degree to the control of man constituted in a state of society, is the main source of his prosperity or of his misery. How many countries have the greedy ambition of princes, and the degradation and ignorance of the people, made barren? Recollect what Asia minor, Judea, Egypt, the provinces at the foot of Mount Atlas have been, and behold what they are at this day. Recollect Greece, once the country of science and of liberty, now that of ignorance and of slavery; she can be only recognized in her ruins, and her monuments of the dead. Man had denied his labour to the earth, and the earth her treasures to man: all vanished with agriculture. The traveller who passes that country of so great renown, finds in the place of the fine forests that crowned its mountains, or

the rich harvests reaped by twenty busy nations of the numerous flocks that enriched its fields, only naked rocks and sterile sands, with here and there a miserable village. He seeks in vain for several rivers recorded in history; they are gone. Thus the rage of conquest and of rule not only overturn cities, depopulate whole countries, and bring back barbarism, but they dry up the very springs from which the natural riches of the earth have flowed.

To these melancholy results of our passions we might oppose the more cheerful ones of our industry; but they are more properly within the province of the arts of cultivation and administration, than of vegetable physiology and botany, our present objects.

Art. IV. *On the use of Clavus, or the Ergot of Rye, in Medicine. By* Jacob Bigelow, *M. D. From the New England Journal of Medicine and Surgery, Vol. V. No.* 2. *Boston.*

Many of the grasses and gramineous plants are subject to a disease, to which vegetable pathologists have given the name of Clavus. In this disease, one or more seeds are usually enlarged or elongated, and project from the spike or panicle to which they belong; they are of an irregular form, a light and brittle texture, a dark colour, and unpleasant taste; and as far as experiments have been tried, they are incapable of germination.

Of the different kinds of grains, rye appears to be most subject to this disease; wheat is often affected with it; barley and oats are said to be also liable to it.

Rye, if not the most subject to this disease, has at least most frequently attracted the notice of observers, in its diseased state. Spurred rye appears to have occurred not only in France and the middle countries of Europe, but also in all

the climates from Sweden on the north to Italy on the south, in both which countries dissertations relating to its prevalence and supposed effects have been published. Owing to the occurrence of certain epidemics, which, for a short time were attributed to this diseased grain, it became a subject of great interest to the community, very different opinions were entertained in regard to its character, and more than thirty distinct treatises and memoirs were published at various times on this single morbid production of grain. In the United States it has lately come into notice as a medicine, and as a suspected cause of the spotted fever being prevalent there.

The circumstances which cause the generation of ergot in grain, are obscure, and have held to many hypotheses. Agricultural observations that have been made respecting it, seem to show, that low and moist grounds produce more spurred grain, than soil which is elevated that dry; that the borders of fields are more subject to it than the central parts; and that new countries, and grounds lately cleared, more frequently give rise to it, than fields which have been long cultivated. It is also said to abound most in rainy seasons.

A number of individuals have carefully watched the growth of ergotted rye in all its stages, but without coinciding in their reports as to its cause. Some have observed a viscid fermenting juice in the glumes, previously to the formation of the ergot; others have detected small larvæ of insects, which being preserved, afterwards hatched into moths or butterflies. Among the more curious experiments relative to this subject, is that of the Abbé Fontana, who planted in his garden a number of single grains of wheat and of rye, and upon the top of each placed several grains of ergot. The result was, a crop in which both the wheat and the rye were infected with ergot. As far as this experiment goes, it seems to indicate something like contagion in the disease, which may very possibly take place through the instrumentality of insects.

To ascertain whether spurred rye be really inimical to health and life, a great number of direct experiments upon animals have been undertaken by different individuals. These trials would doubtless have settled disputes relative to the

properties of the articles, had it not been for the wide and unaccountable difference which has appeared in their results, and from the discordancy of the reports little satisfactory information is to be drawn from them.

After the foregoing statements, we proceed to lay before our readers what is said by Dr. Bigelow, with respect to the use of the ergot of rye as an article of medicine.

Since its medicinal qualities began to excite notice, the ergot of rye has been continually observed, in various parts of the northern and middle States. I do not know that definite observations have been made in regard to the kind of soil producing it, except that new grounds, or the soil of tracts newly cleared up, are more disposed to give rise to it, than old fields, or those that have been long cultivated. Spring rye is considered by some to be more liable to it, than that which is sown in the fall. Wheat appears to be affected by the same circumstances as rye; and considerable quantities of the ergot of that grain, brought from Vermont, have been offered for sale at the druggists' stores in Boston.

The spurred rye of this neighbourhood has a peculiar nauseous taste, attended with very little acrimony. When snuffed up the nostrils it does not prove sternutatory. Taken into the stomach, in some individuals, it occasions nausea in the dose of a scruple. A drachm excites greater nausea, and in many instances produces vomiting.

It has not in general appeared to quicken the motions of the alimentary canal; large doses have occasioned head-ach, and temporary febrile symptoms.

The most remarkable effects of spurred rye, and that for which it has come into medicinal use in this country, is its power of acting, under certain circumstances specifically upon the uterus. This property was first announced to the public by Dr. Stearns, of New York State, in 1807. It has been further investigated and discussed by Dr. Prescott, of Massachusetts, in a dissertation published in 1813, and by various writers in the different journals and gazettes. The use of this article in medicine is, to the best of our knowledge, an exclusively American practice, and if it is now

introduced into any part of Europe, it must be from the publications of this country.

It is now well ascertained, by the experience of a number of years, that the spurred rye given to parturient women, has an unequivocal effect, in increasing the force of the uterine pains, and hastening the delivery of the child. This effect it sometimes fails to produce; but its failures are not more frequent than those, to which almost any other article in the materia medica is liable. Its character as a medicine, is so well established, that a majority of practitioners in Boston, and probably throughout this State, are in the habit of employing it in cases where a medicine of this sort is indicated. Under proper regulations, it may be considered a valuable addition to the present stock of medicinal agents.

When given prematurely, or under improper circumstances, spurred rye has proved injurious to the mother, and still more frequently to the offspring. The first cautionary hints on this subject were given in this Journal more than four years ago. When administered at too early a stage, or while considerable obstacles to delivery exist, it creates unnecessary suffering to the mother, and endangers the child's life. The principal circumstances which contraindicate its use, may be found in the various notices that have been published on the subject. Among them may be mentioned earliness of the stage, rigidity of the soft parts, any unfavourable conformation, or any presentation that requires changing.

From its power of stimulating the gravid uterus, practitioners have been led to try its effects on the uterine system under other circumstances. In the disease of amenorrhea it has been given to a considerable extent, with various success, in the hands of different physicians.

Dr. Thacher mentions one or more cases in which the obstructed catamenia were restored by a small quantity, a drachm only, of this medicine. Dr. Prescott, and some others, have mentioned cases of its failure. I have given in two instances an ounce in substance, in the course of a week, without effect. But the following statements, communicated to me by Dr. John Randall, appear to contain more extensive

trials both of the efficacy and safety of the medicine, than any I have met with. His statements are as follow.

"The case in which I gave the greatest quantity of ergot, was one of amenorrhea, and happened about three years since. The quantity of the medicine taken was six ounces. The patient was furnished with the ergot at two different times; two ounces, the first; and four, the second time. The medicine was prepared with a quart of water to an ounce of ergot, boiled down to a pint. The first quantity as directed, was taken in five days; but the second, from the great solicitude for relief, was taken in less than four days; so that more than an ounce was taken in a day. The patient was relieved, no unpleasant effects occurred at the time, and she has remained in perfect health ever since.

"The next case of magnitude was Mrs. T.; she has taken the ergot for amenorrhea at three different times, at the rate of four drachms a day. An ounce relieved her at first, the same quantity the second, and two ounces the third time. No dangerous symptoms happened to her on any of the occasions, and she has enjoyed as good health since, as she ever did before.

"I have given half an ounce per day to another person for four successive days, without any ill effects, but without giving the relief desired. Four other persons, by my direction, have taken an ounce each in the quantity of half an ounce per day, with perfect relief, and without injury.

"The symptoms produced in the seven preceding cases, as far as I have learnt them, were head-ach, increased heat of body, and occasional pain in the hypogastric region. Probably sickness of the stomach may be added, although I have not always noticed it."

The foregoing cases sufficiently show that the spurred rye may be given to a very considerable extent, without other injury than the temporary inconvenience which occurs at the time of its exhibition. It would also seem entitled to the rep tation of an emmenagogue; at least as much so, as many remedies of that uncertain class which are now in use.

In regard to the preparations of this medicine, the infusion

and decoction appear to extract all its active properties. The latter operates more speedily, than where the crude powder is given. The dose usual administered to women in labour is from ten grains to half a drachm in decoction, to be repeated if necessary. Some practitioners begin with a drachm. Patients who have taken this last amount, frequently vomit before, or after delivery.

The ergot of wheat has been the subject of a few trials, which serve in some degree to establish its affinity to that of rye. Its taste is equally nauseous, and somewhat more unlike that of the original grain. I have seen it occasion nausea in the dose of a scruple, and vomiting when a drachm had bee given. In some cases of labour it has evidently increased the uterine efforts; in one, it produced no effect.

In regard to the agency of spurred grain in generating the epidemics,* which of late years have appeared in various parts of the United States; the question is too extensive to be hastily decided on by an individual. The suspicions which have been cast upon this article, no doubt had their origin in the terrors which it formerly excited in Europe. It is probable, if the ergot has any instrumentality in generating disease, that it requires, to say the least, the assistance of some co-operating cause; since we have seen it can be taken to a greater extent, than it ever would be for the purposes of food, without any permanent injury; and also, since we have sufficient evidence, that it has existed in this country long before the diseases, that have been laid to its charge; and when people were not led to avoid its use, by any knowledge of its medicinal powers.

Since, however, the ergot in large quantities would prove injurious in food, from its medicinal agency; and in smaller quantities would impair the taste and nutritive qualities of bread; it is always desirable that it should be separated, as far as possible, from the sound grain. This may be accomplished to a sufficient degree, by care in the process of winnowing. The grains of ergot being lighter and generally larger than the sound grains, are either detained by the sieve,

* Particularly the spotted fever.

or blown away by the wind. Those who collect ergot for the druggists have told me that they procure it in larger quantities from the chaff, than from the grain. It is probable in all cases, if the winnowing be properly repeated, the grain will without difficulty be made sufficiently pure for use.

We add the following extract from a letter in the same Journal on the use of ergot, by a medical practitioner, who states that he had frequently used it in cases of labour.

1st. In late stages of lingering labour, where the strength of the patient is exhausted with inefficient pains, and where the remaining obstacles to delivery appear to consist, not in resistance to the progress of the child, but in the insufficiency of the uterine efforts. Every practitioner accustomed to its employment must have seen the most satisfactory instances of relief afforded by it in these cases, without the attendance of any unpleasant consequence. Instances sometimes occur under its use, where children are born in a torpid state, and are with difficulty resuscitated. A few have been lost, from long continued pressure upon the head, occasioned by the constancy of the pains. But similar instances from the same causes will, now and then, take place where no ergot is given. We may also reasonably hope, that future experience will so far establish the dose, preparation, and mode of exhibition of this medicine, that it may be given without apprehension, and with a tolerable certainty of the effect for which it seems calculated, the promotion of regular and efficient labour.

2nd. Where the child is dead. In this case labours are often lingering, and nothing is to be apprehended from the proper use of ergot. In some instances, however, of this kind, it has appeared less active, than it is under ordinary circumstances.

3d. In retention of the placenta. I have given it in two cases of the hour-glass contraction, with immediate relief.

4th. In uterine hæmorrhage. It is commonly noticed, that there is less flooding after cases in which ergot has been employed, than when it has not. In several instances of a profuse discharge of the lochia, it has been given with great

benefit. In the case of a woman who had suffered excessively by flooding in all her previous labours, it was given to a considerable extent, and no troublesome hæmorrhage occurred.

5th. In lingering cases of abortion, where miscarriage has become inevitable, and it is desirable to abridge the term of hæmorrhage and confinement. In one case of this kind it has failed to give relief, but future experience may find it serviceable.

Art. V. *Some Remarks on the Arts of India, with miscellaneous* Observations *on various Subjects. By* H. Scott, *M. D.*

I have hesitated a good deal with regard to the subject which I should choose for this paper, from the great variety that present themselves to my mind. I have fixed at last, on the most important operation for the cure of blindness that has yet been practised in any country—the removal of the crystalline lens when it becomes opake. At what period this discovery was made in India will, I fear, never be known, nor to what demigod we are indebted for so great a relief to suffering humanity. It is probably very ancient; for ages have, I think, passed away since much addition has been made to knowledge in India. It cannot be supposed that a people so often invaded by barbarians, so often subjected to a foreign and cruel dominion, should have leisure or ability to make and preserve observations of this kind. But whatever may be the origin or antiquity of the operation of India for cataract, I know that it is occasionally very effectual. That it renews to many melancholy beings their long lost communication with the external world, and brings them once more "within the precincts of the cheerful day."

I cannot venture to say that the Indian operation for the cataract is worthy of our imitation; this must be decided by those better qualified to judge than I can pretend to be. I

shall confine myself to a plain narration of what I have actually seen, with such observations on it as have arisen in my mind. I think I have been a witness of this operation four times, and performed by two different operators. Those people occasionally travel to a distance to practise their art, but I believe they never leave their homes unless on being called to some certain employment. All those that I saw in Bombay, were Moormen, and their general residence was in Guzurat. One of those practitioners was a young man, the other aged; they came at different times, and were unconnected with each other. The young man had, I think, the most skilful hands of any person that I ever met with. He seemed to feel every thing that he touched with as much delicacy as a spider, and the operations which I saw him perform were executed with surprising skill. Celsus observes that a surgeon ought to be a young man, or of an age approaching to youth. "Esse autem Chirurgus debet adolescens, aut certi adolescentiæ propior." The feeling, the elasticity, the pliability of youth, with its perfection of sight, are never more necessary than in the operation for the cataract.

I have, unfortunately, not brought to Europe the Indian instrument for couching, but I have had a set made here by an ingenious workman, from my recollection of them. They cannot be far from affording a true representation. The first instrument, A, (Plate II.) is for perforating the coats of the eye. It is sharp-pointed, but soon becomes thicker than a common lancet. This seems to be necessary, for two reasons: 1st, to avoid the risk of its breaking, from the thickness and density of the sclerotic coat; and 2dly, to make an opening of sufficient size to pass the instrument B, for depressing the lens. The instrument A is made of steel, but B, I have always seen made of brass. About the 4th or 5th of an inch above the point of the instrument A, they wind a thread for preventing its passing farther into the eye than is intended. It is a curious circumstance, that the opening made through the sclerotic coat is at the very point where it is now made in Europe; that is, behind the edge of the cornea, and about, or a little below,

the axis of the eye. My skilful operator desired the patient to look at a particular object, and in a moment he pierced the eye at the very point which he ought to have done, and without using a speculum to fix it.

When an opening is thus made through the sclerotic coat, the instrument A is withdrawn, and that marked B, introduced. This instrument may be described as a cylinder, terminating at one end in a pyramid of three sides, with a blunt apex. Between the cylinder and pyramid, at their junction, is a neck, or part somewhat smaller than the rest, as marked at C. On being inserted, it is so managed as to push down the lens below the pupil. This is done slowly, but effectually, twice or thrice, the operator looking attentively for a little time afterwards at the eye, to be convinced that he has quite removed the lens, and placed it below the transparent cornea. He then slowly draws back the instrument till he finds that i hangs from the narrower portion, or shoulder, at C. In this position it produces no kind of irritation, while the strength of the sclerotic coat keeps it from falling out entirely. Both eyes are then covered carefully with several round cushions of cotton wetted with water, so that the patient is in perfect darkness. With the eyes so covered, and with the instrument still in the perforation, the head of the patient is allowed to rest on a pillow for 15 minutes, or even half an hour, till the spasms that may have been excited in the eye have entirely ceased. They are then uncovered and carefully examined. If the lens or any part of it has risen it is again depressed by the instrument B. They are a second time bound up as before, for a like period of time, and then re-examined, to ascertain if any farther depression is necessary. This process is even gone through a third time, so that their operation is tedious; it requires a long time, but it seems not to give any material degree of pain or uneasiness. When in this way they are quite satisfied that the lens is sufficiently removed, they tie the wet cotton cushions over both eyes, and put the patient to bed. He is kept there in darkness and repose for about a week, living on little else than boiled rice.

When I first saw the Indian instruments for couching, I

looked on them with contempt. I thought the instrument B, in particular, clumsy and ill fitted for its office. But experience has altered my opinion. Its size is perhaps of advantage, for by means of it the lens is readily removed, while its coat is completely torn and detached. There is thus less risk of the lens returning to its former position, while its absorption is promoted and ensured.*

If any person will consult Celsus, he will find that his operation for the cataract does not differ from the present practice of Europe, and no doubt gave rise to it. He perforates the eye with the same needle (acus) that he uses for depressing the lens; and he advises, if the lens cannot be kept down, to cut it to pieces with this acus; so that his instrument must have had both a sharp point and a cutting edge: " si hæsit (says Celsus) curatio expleta est, si subinde redit, eadem acu concidenda et in plures partes dissipanda est; quæ singulæ et facilius conduntur et minus late officiunt."

There is sufficient evidence that the astronomy and the Algebra of the Hindoos had a different origin from what we have learned of those sciences from the Greeks or Egyptians. May not the same observation be applied to the subject of this paper? From whatever source the operation of Celsus reached the Greeks, and through them, I suppose, the Romans, it differs so much from the method of India, as may lead us to think that they had not a common origin. Facts like those would lead me to suppose that there never existed more than a very partial or a very temporary intercourse (such as now takes place) between India, Egypt, and Greece. The recent introduction into Europe of the Arabic cyphers or digits affords, I think, a proof of the same kind. It has been supposed that a knowledge of them was first brought from Spain to France before the year A. D. 1000, by the justly celebrated Gerbert, and that he had learned the use of those figures from the Saracens, who had settled in that country. The introduction, however, of this method was probably much later than the time of Gerbert. Mathew Paris calls

* Celsus seems to be of this opinion—for he says " tum acus admovenda est, aut acuta, aut forte *non nimium tenuis.*"

them the Grecian numerals, and says they were brought from Athens by John Basingstoke, about the year 1240. I have no doubt but what we owe to India, and not to Greece or Arabia, this inestimable invention. The forms of those Arabian or Grecian characters are nearly the same with these we use at present, and the whole mode of employing them for the expression and management of numbers is exactly the same. How superior is this to the numeral letters of the Romans!—Does not our comparatively late knowledge of this noble invention afford an additional proof that the extensive connection between India, Egypt and the more Western world (which has been supposed to have existed) could never have taken place? Such an argument appears to me far more conclusive than the sounds of words, uncertain etymologies, or geographical conjectures. The wanderings in the East of shepherds or of tribes in the early periods of society, with regard to which so much has been said, may be ranked with the stories of the Arabian Nights, and are in my opinion about as authentic and useful.

I asked my Indian operator by what means he had acquired his knowledge of this operation. He replied, from his father. They practised it from father to son. He had never seen the dissection of the eye of any animal, nor does he believe that any of his family had. In spite of all this, it is impossibe not to think that the knowledge of this very delicate operation must have been derived from actual dissection; for an error even of a small space, would inevitably lead to a destruction of vision for ever.

I was so struck with the skill of this man, that I was very anxious to ascertain from him the general result of his practice, the proportion of his successful and unsuccessful operations. He acknowledged at once that he kept no register nor account of them; but on my pressing him much to make some conjecture of the number in one hundred who were improved by the operation, and of the number who received no benefit from it, he said, after a good deal of hesitation, that he did not think above five in one hundred remained without benefit. I had no means of ascertaining the real state of the question with

more certainty; the man was a stranger and soon returned to his country, and I never saw him again. I leave it to the reader to form his own conclusions on this subject.[6] He could have but little interest in deceiving me; but, as is too frequently the case, he might wish to give himself consequence by magnifying his success; he might have forgotton many of his failures; and without supposing that he meant to mislead me (which I should reluctantly do), we ought probably to make a large deduction from the favourable side of the account.

I shall say nothing of the remedies used by the Indians for inflammation of the eyes, for that is a subject purely medical, for which this is not an appropriate place; nor indeed do any of their remedies produce such effects, as I should judge to be peculiar, or very interesting. So far as my own experience goes, I am disposed to think that the ophthalmia of Egypt, like the plague of the Levant, or the typhus fever of Europe, cannot be propagated from one man to another in India, but that its infection or contagion is rendered inert by the unceasing heat of that climate. I can suppose than an increase of temperature may induce those poisons to enter into new combinations with the air, or some of its component parts. H. SCOTT.

38, *Russel Square, August* 2*d*, 1816.

P. S. Does any thing like the operation that I have described appear in the medical writings of the Arabians?

ART. VI. *Sandwich Islands. Voyage round the World by* Archibald Campbell, *a Mariner,* 1816.

THE sudden revolution produced in the customs of the natives of the *Sandwich* islands, from their intercourse with the *Europeans*, gives a peculiar interest to any recent accounts of them, from which we may be enabled to trace the progress of society in one of its earliest stages. These islands, from their situation, midway between the continents of *Asia*

and *America*, the fertility of their soil, and the natural talents and industry of the natives, are rendered by far the most interesting of the recent discoveries in the Pacific ocean, and so were considered by Captain *Cook*.

When Captain *Cook*, in 1778, discovered the *Sandwich* islands, *Tereoboo* was king of *Owhyhee*; *Teteree*, of *Moratai*; and *Pedeoranne* of *Wahoo*, and the islands to the leeward. *Tamaahmaah*, the present king, is known in *Cook's* Voyage under the name of *Maiha-maiha*, and was present at the death of that illustrious navigator: he was only brother to *Tereoboo*.

From the departure of the *Resolution* till the year 1787, no ship visited these islands. In 1788, Captain *Douglas*, in the *Iphiginia*, touched at *Owhyhee*. *Tamaahmaah* at this time having obtained the assistance of *Boyd*, a ship carpenter, built a small tender, and it was at this period that *Young* and *Davis*, the persons subsequently noticed, became resident at *Owhyhee*. After the arrival of Captain *Vancouver*, the king, with the assistance of the ships carpenters, constructed his first decked vessel; and in order to ensure the good will of the English, a formal surrender of the sovereignty of these islands was made by the king, reserving, however, freedom in all matters of religion, internal government, and domestic economy. *Tamaahmaah*, after various successes, had in 1810 reduced all the islands in this group under his dominions, except *Atooi* and *Onehooi*.

Scarcely thirty years have elapsed since the period of the discovery of these islands; and we already find a chief who has made rapid progress towards civilization, and who on all occasions has availed himself of every opportunity of intercourse with the *Europeans*, surrounded by artificers, with guards regularly trained to the use of fire arms, and a navy of 60 sail of decked vessels, built on the island; almost every vessel that navigates the *Pacific*, finds shelter, provisions, or trade in his harbour. Much is to be ascribed to the natural ingenuity and unwearied industry of the inhabitants; but added to this, they have received all the benefits which are conferred on rising communities, by the appearance of their chief, *Tamaahmaah*, "one of those great men who go before their age."

The death of Captain *Cook*, and the frequent murders by the natives of the subsequent navigators, gave such ideas of the savage nature of the inhabitants, that for many years few ships ventured to touch there. But since the present chief has established his power, his conduct has been marked with such justice, that strangers are as safe in his ports as in those of any other nation. He is known in this country from the accounts of *Turnbull*, *Lisianski*, and *Langsdorf*, and much interest has been excited respecting him; but none of these navigators ever saw him. From a volume recently published, "A Voyage round the World, by *Archibald Campbell*," we have some farther account of *Tamaahmaah*, and from one who, by residing with him, had every opportunity of personal observation. *Campbell* was a native of a village near *Glasgow*, and having escaped from an *English* man of war, entered himself on board an *Indiaman*. Whilst at *Canton*, he was enticed from his ship by the commander of an *American* vessel, bound to the north-west coast of *America*, on which coast the vessel was afterwards wrecked. Before they reached *Kodiak*, his feet becoming mortified from the extreme cold, were both amputated at *Kodiak*, by a *Russian* surgeon; here he remained some time, employed to teach the children of the natives *English*. In the hope, however, of meeting with *American* vessels at the *Sandwich* islands, in which he might return home, he was induced to leave *Kodiak*, in the *Neva* (the ship commanded by Captain *Lisianski*, in Captain *Krusenstern's* expedition). From *Kodiak* they proceeded to the island of *Wahoo*, being the one of the *Sandwich* islands now chosen by *Tamaahmaah* for his residence. *Campbell's* appearance having excited the compassion of the queen, he was invited to reside in her house, and being recommended by the *Russian* captain to the king, was employed as a sail maker in the royal arsenal. After remaining in the king's establishment for several months, he removed to the house of *Isaac Davis*, a *Welchman*, who had been on the island about twenty years. Soon afterwards a tract of land of about sixty acres, on which fifteen families resided, was granted to him by the king. After having overhauled all the sails of the fleet,

he managed to construct a loom, and began to weave sail cloth; and being by trade a weaver, he succeeded in making some before he quitted the island. But in July 1810, a South Sea whaler, bound for *England*, having touched there, the desire of revisiting his native country, and the hopes that the wound in his legs (which had never healed since amputation) might be cured, he was tempted to abandon his possessions, and leave his situation of ease, for one which in his helpless situation must at least be precarious. On applying to *Tamaahmaah* for permission to depart, he said, "if his *belly* told him to go, he was at liberty to do so," sending by him his compliments to *King George*; expressing, however, much astonishment at hearing, that *Campbell*, together with many thousands of others, his subjects, had never seen their sovereign. By the captain of the ship he sent a present to the king, of a feather cloak, accompanied by a letter, which he dictated, reminding him of Captain *Vancouver's* promise of sending a man of war, and regretting that the distance pervented his assisting him in his wars. From *Wahoo*, *Campbell* went to *Rio Janeiro*, and after a residence there of two years returned to *Scotland*. On his return he procured admission to the infirmary, at *Edinburgh*; but was at length discharged as incurable. He was noticed by Mr. *Smith* on board one of the steam boats on the *Clyde*, playing on the violin for the amusement of the steerage passengers. Mr. *Smith* took him home, and struck with the intelligent manner and the interesting nature of the incidents he related, was induced to become the editor of his narration, and to publish it for his benefit. "Few," says Mr. *Smith*, "in the same situations of life, are possessed of more intelligence or information, and with the advantages common to his countrymen, he seems to have neglected no means of improvement." The greater portion of this book is occupied in a narrative of what occurred during *Campbell's* stay at the *Sandwich* islands, and a description of them and of the manners of the inhabitants. This is by far the most interesting; and we shall conclude this article by a few extracts from that part of it.

"The king's residence is built close on the shore, and is

distinguished by the British colours, and a battery of sixteen guns belonging to his ship, the "Lilly Bird," then unrigged in the harbour; there was also a guard-house and powder-magazine, and two extensive store-houses built of stone for the reception of European goods. His mode of life is very simple, breakfasting at eight, dining at noon, and supping at sun-set. His principal chiefs are always about his person. On concluding his meal he drinks half a glass of rum, but the bottle is immediately taken away, the liquor being interdicted to the guests. At one period, it is said, he was much addicted to the use of spirits, but foreseeing the baneful effects arising from indulging in their use, he made a resolution to abstain from them, and which he has since religiously maintained. The greatest respect is paid to his person by all: even when his meat and drink passes by, his subjects uncover themselves, and stoop down by way of reverence. The white people, however, on the island, are not required to pay these honours. *Davis* and *Young*, the two persons before noticed, are much favoured by the king, and are raised to the rank of chiefs, and have extensive grants of land. The lands are in the highest state of cultivation. The island of *Wahoo*, though only secondary in size, is one of the most important on account of its fertility, and because it possesses the only secure harbour to be met with in the group. During the thirteen months *Campbell* was at *Wahoo*, about twelve ships touched there. The navy, in 1809, was about sixty vessels: these were then all hauled on shore, and preserved with great care, it being time of peace: these were chiefly sloops and schooners under forty tons, built by native carpenters under the direction of *Boyd*. The "Lilly Bird" is, however, about two hundred tons; but this vessel was bought from the *Americans*. *Indian* corn and many garden vegetables are cultivated with success; and in a short time the breed of cattle, horses, and sheep, left there by Captain *Vancouver*, will be abundant. The king has several horses, and is fond of riding. Many individuals have large flocks of sheep; and in some of the large islands there are considerable herds of wild cattle. The chiefs are proprietors of the soil, and let the land in small farms to the lower

orders, who pay rent in kind; the chiefs pay a rent and other subsidies to the sovereign. There were at *Wahoo* at one time, during our author's stay, about sixty whites, chiefly *English*, left by *American* vessels; several amongst them were convicts who had escaped from *Now South Wales.* Many inducements are held out to sailors to remain; if they conduct themselves with propriety, they rank as chiefs, and are at all events certain of being maintained, as the chiefs are always anxious to have white men about them. Many artificers are in the king's employ; all that are industrious are well rewarded by him; many, however, are idle and dissolute, particularly the convicts; the latter have introduced distillation into the island, and give themselves up to drinking. *Davis*, a *Welchman*, who was very industrious, so puzzled the natives, that they could only account for his singularity by supposing him one of their own countrymen, who had gone to *Cahiete*, or *England*, and after his death had returned to his native land. Most of the whites have married native women, by whom they have families, but no attention is paid by them to their education or religious instruction. The chiefs about the king have each a separate office assigned to him—as treasurer, &c. The king is entireiy absolute.

" Though the people are under the dominion of some chief, for whom they work or cultivate the ground, and by whom they are supported in old age, they are by no means to be considered as slaves attached to the soil, but are at liberty to change masters when they think fit. The principal duty of the executive is entrusted to the priests, and by them the revenue is collected and the laws enforced. They believe in a future state, when they will be rewarded or punished for their conduct in this world. There were no missionaries on the islands.

" The use of *ava* is now giving way to that of ardent spirits; they are very fond of smoking tobacco, which grows in great abundance. Many of the natives who are employed as carpenters, coopers, blacksmiths, and tailors, do their work as skilfully as *Europeans*; and at the king's forge none but natives were employed. All dealings are conducted by barter; they know, however, the value of dollars, and take them in

exchange; but these are rarely brought out again into circulation: vessels are supplied with fresh provisions, live-stock, salt, and other articles of out-fit, giving, in return, fire-arms and all other European articles. Sandal wood, pearls, and mother of pearl, the produce of these islands, are frequently purchased for the China market. It is probable that the *Russians* will in future derive from hence the principal supplies for their settlements on the *Fox* islands, and north-west coast of *America*, and even *Kamschatka*. Whilst the author was with the *Russians*, it seems it was in contemplation to establish a settlement at one of these islands, though this project was afterwards abandoned; and it is obvious that at no very distant period, these islands must become objects of great importance to *America*. Provisions, from the frequent arrival of ships, are not cheap.

"There is no regular armed force, except about fifty men of the guard, who constantly do duty about the king's residence; twenty mounting guard each day, armed with muskets and bayonets: in their exercises, rapidity is more regarded than precision. All the natives are trained to arms, and are bound to attend the king's person in his wars. Although he is anxious to induce white people to remain, no encouragement is given to deserters; nor are those who wish to depart detained. In 1809, says *Campbell*, the king seemed about 50, stout and well made; the expression of his countenance agreeable; mild and affable in his manners, and appeared to possess great warmth of feeling; and though a conqueror, is very popular amongst his subjects: he has amassed by trade a considerable store of goods, and treasure in dollars. He encourages his subjects to make voyages in the ships which touch at the island: and many have been to *China*, and even to the United States, and has amongst the natives many good sailors. His residence was built in the European style. He had two wives, and was about to take a third."

We shall conclude our extracts from this book, with the following description of the author's journey to take possession of his farm. "We passed by foot paths winding through "an extensive and fertile plain, the whole of which is in the

"highest state of cultivation; every stream was carefully em-"banked to supply water for the taro beds; where there was no "water, the land was under crops of yams and sweet potatoes; "the roads and numerous houses are shaded by cocoa nut "trees, and the sides of the mountains covered with woods to "a great height; we halted two or three times, and were "treated by the natives with the utmost hospitality. Fifteen "persons with their families resided on my farm, and they "cultivated the ground as my servants; there were three "houses on the property, but I found it more agreeable to "live with one of my neighbours, and get what I wanted "from my own land."

ART. VII. *Notice respecting Travels towards the Interior of South Africa, in the years* 1811-1815. *By* William John Burchell, *Esq.*

We are fortunate enough to be able to lay before our readers a short Sketch of the very interesting Travels of Mr. Burchell, who has lately returned to this country.

IN June 1811, Mr. Burchell left Cape Town, and travelled in a north-easterly direction, and on the 3d of August passed the last habitation at that time occupied by the colonists; and the Zak river, the boundary of the colony, in the beginning of September; and having escaped an attack froom a kraal of Caffres, crossed the Orange river, called Gariep (i.e. *river*) by the Koraquas. On the 30th he arrived at a village named Klaarwater, where some missionaries have resided for several years, with a considerable number of Hottentots, of a mixed race, the greater part of whom had formerly emigrated from the colony. Here it was necessary to remain some time to recruit the strength of the oxen, which had become consider-

ably reduced by want of water and fit pasture. During his stay he made an excursion up the 'Tky Gariep, or Yellow river, a branch of the Orange or Great river; but on making preparations to resume his travels further into the interior, he discovered that such of his men who had entered into his service at Cape Town, as belonged to the missionary station, were unwilling to accompany him further than the town of Litáakoon, giving as their reason, that as Dr. Cowan and his party, among whom were two Hottentots from Klaarwater, had set out on a similar expedition three years before, and had not been heard of (and therefore was most probably murdered), they did not consider it safe to venture beyond that town. Mr. Burchell found it impossible by any offers of high wages or promises of reward, to persuade a single Hottentot belonging to this place to join him. Thus situated, he had no resource but to return into the colony, where Hottentots might be found less timid, or less acquainted with the supposed melancholy fate of Dr. Cowan. For, having two waggons, it was quite impossible to manage them with only three men, which were all that could be induced to continue their services, and one of those was disabled.

Graaf Reinet appearing by the maps to be the nearest point where assistance could be obtained, he resolved upon attempting to reach it; but as the country to be passed through was a tract which had never been before explored, and as the missionaries were averse to the opening a communication between their village and the colony, many difficulties, arising both from the nature of the country and the inhabitants, were suggested; and it was not without much persuasion and some management on the part of Mr. Burchell, that he procured six people to accompany him on that journey, in addition to two of his own men.

Having previously ascertained by astronomical observations the bearing of Graaff Reinet, and leaving one of his men in charge of his waggons, he set off on the 24th of February, 1812; his party consisting of six Hottentots, a Bushman, and a Bachapin, mounted on oxen, himself on horseback. Having crossed the Orange river by swimming, they proceeded

by the direction of the compass through a country of varied surface inhabited by tribes of Bushmen, who, without suspicion, allowed them to enter their kraals or villages, and in several instances afforded them essential assistance. On this journey, Mr. Burchell observes, he had "the good fortune, not enjoyed "perhaps by any former traveller, to be admitted into their "domestic circles without reserve, and had frequent opportu-"nities of observing their real character."

On the 25th of March he arrived at the village of Graaff-Reinet, and by means of the acting Landdrost (to whom he presented the papers with which he had been furnished by the Colonial Government), succeeded, after a delay of a month, in hiring seven Hottentots. These, however, with one exception, proved to be a worthless set; and although this was at the time suspected to be so, he was foiled in procuring better. Returning by the same route, he met with the same friendly reception from the natives. By hunting, they supplied themselves with food: travelling the whole of the day, and when towards evening they met with water, there they halted for the night, under shelter of some tree or bush; though even this protection was not always to be procured.

On the 24th of May he reached Klaarwater, and spending nearly a fortnight in preparing the waggons and making some arrangements necessary for so long a journey, resumed his course towards the interior.

Mr. Burchell was the only European or white person in the expedition; consequently the whole care of planning its daily progress, and conducting it, devolved on him; and he was compelled to be incessantly on the watch for its safety, and give orders for the smallest movement; his men seeming to have taken a resolution not to render him the slightest assistance. The party consisted of ten Hottentots, and an interpreter, whose mother was a Koraqua and father a Bácha-pin; and they had two waggons drawn by oxen, three horses, and a number of dogs. They advanced but slowly, much time being occupied at different places in making observations, and in preparing and disposing of the collections of the preceding day.

The productions of this part of the couutry, both in zoology and botany, were very different from what are found within the colony: such were the manis; a new species of rhinoceros; several of the dog genus and of the feline tribe; a lynx; many of the genus viverra; a hedgehog, several of the murine kind; the camelopardalis; five antelopes, one of the horse genus, &c. Of birds, a great number were found peculiar to the northern side of the Orange river, amongst which an otis and a mycteria were most remarkable for size. Several new lacertæ and testudines were found; and a great variety of serpents Of new fishes, only a silurus and two cyprini, were observed in the rivers. Many curious insects were collected. In botany, the face of the country had no resemblance to that of the more southern regions. The surface of this part of Africa was more flat than mountainous; and when mountains occurred, their strata were, in the greater number of instances, horizontal. In some places granite was observed. The plains often appeared to be of boundless extent, of an uninterrupted level, and frequently destitute of water. The soil was generally a red sand, clothed chiefly with tall grass (the verdure of which was but of short duration), relieved by clumps of acacia, tarchonanthus, &c. In one part of these plains is an immense forest, the extent of which is unknown to the Báchapins, who are that tribe of Bichuánas inhabiting Litáakoon. It is composed chiefly of Acacias of various sorts, with sometimes Zizyphus, Royena, Tarchonanthus, Terminalia, and some others; is inhabited by elephants and giraffes in great numbers, two species of rhinoceros, and a kind of buffalo, and many other large animals.

On the 13th of July they arrived at Litáakoon (or rather, as Mr. Burchell observes, Litáakun, according to the system of orthography adopted for the Sichuána language), the chief town of the Báchapins, where Mattivi, the king or chief, received them favourably. Here Mr. Burchell found it necessary to remain till the 27th of September, in order to complete his observations; but being constantly surrounded by the natives, who, by their incessant begging and importunities, scarcely allowed him time for rest, and who, uninvited,

assisted in the consumption of his provisions, he was obliged during that period to absent himelf on a hunting excursion, as well as to lay in a stock of dried game, as to get some respite from the fatigue of gratifying the curiosity of these people, and to record and arrange all he had been enabled to observe.

During this stay he was employed in drawing portraits of the natives, views of the town, learning their language, which is spoken by all the surrounding tribes, observing their customs, and collecting whatever was to be found in the environs. Litáakun contains about eight hundred houses and nearly five thousand inhabitants, and Mattivi's government extends over all the surrounding country in different directions for several days journey. Both the chief and his people were very adverse to Mr. Burchell's forming any acquaintance with the tribes beyond them, and even hinted that he would not be allowed to travel in that direction. However, on persisting in his resolution of advancing towards the interior, he met with no positive opposition, though the fears which the accounts instilled into the minds of his men were in the end the means of his being obliged to return.

From this time the timidity of his people was every day a cause of fresh vexation and difficulty, and even of danger; and the various means they tried to induce him to return to the Cape were not to be overcome, but by shewing the utmost resolution not to be diverted from pursuing the plan originally laid down. Their misconduct increased daily, neglecting their duty, and doing every thing to discourage him from proceeding; and it was only as it were by main force, that he got them on as far as the borders of the Karrikarri country. There their fears rose so high that they declared their intention of turning back, and leaving him, if he persisted in advancing. Unable any longer to contend with a timidity against which reasoning produced no effect, Mr. Burchell was compelled at this point to terminate his progress northward. He remained, however, three weeks, still hoping that some circumstances might arise to favour his penetrating further. During that time he made excursions

in various directions, and was visited by the Barólongs as well as by the Bakárrikarri, from whom he obtained some information respecting the countries and people beyond. He found that place to be in a parallel of latitude one degree north of Litáakun.

On the 27th of October, a day of rejoicing for his men, he reluctantly turned his course southward, and travelling over plains of sand, in which much was suffered from the heat, the thermometer being between 90° and 100°, and from the scarcity of water, they reached the town of Patáni, inhabited by a tribe of Bichuánas called Bamuchárs.

After a short stay they resumed their journey, and travelling five days, halted near the old deserted Báchapin town on the Krúmani river, where they remained stationed for a month, for the purpose of hunting such animals as were wanting to the collection, and for collecting whatever subjects of natural history could be obtained in excursions in the neighbourhood. This being accomplished, the party quitted the Báchapin territory, and passing the Kambánni mountains, fell into their former track. At one place they were obliged to take prisoners and disarm a party of Bushmen of a hostile tribe.

On their return to Klaarwater, they learnt that the people of that place had attacked and dispersed a kraal of Caffres, who being thus irritated, were supposed to be lying in wait for Mr. Burchell's party, to plunder him of his ammunition. After repairing the waggons he hastened to cross the Orange river, which being full, much time was spent in constructing rafts. In swimming them over, he was assisted by the Koraquas (called also Koras and Koronas), who reside on its banks.

By following their track through a more eastern country than that through which he at first travelled to Graaff-Reinet, he followed the course of the Nú-Gariép, or Black river, and at the same time escaped the Caffres, who were lying in wait for them on the Brack river. The Nú-Gariép is nearly as large as the Orange river, into which its waters are discharged. Mr. Burchell is the only person who has traced the course of this stream from its junction with the Gariép. During the preceding part of the journey they sub-

sisted themselves by hunting, living entirely on animal food, dried in the sun. During the latter part of this journey the game became scarce. On the 11th of March 1813, they found themselves within the colonial boundary, at its north-east point, on the Zeekoe river; and on the 31st they arrived at Graaff-Reinet, where most of the men were exchanged for others; and after repairing the waggons, and decreasing their load by sending off part of the collection direct to Cape Town, he resolved, instead of proceeding thither himself, to explore the whole length of the colony; and taking the road over Bruyntjes-Hoogte to the Boshberg, descended the Great Fish river (which separates the Boers from the Caffres) as far as its mouth. Nearly four months and a half were employed in examining the country between Graaff Reinet and the mouth of the river. From thence to the Drosdy of Uitenhage six weeks more were consumed. When arrived there, the waggons were found to be so much over loaded, that there was no room for further collection, and a favourable opportunity offering, the greatest part was shipped at Algoa bay, and sent to Cape Town.

Having exchanged most of his Hottentots for others, he left Uitenhage on the 26th of January 1814, and arrived at Plettenbergs bay in April. As the beautiful Auteníqua country, and the immense trees of its forests, had never been sufficiently investigated by a naturalist, four months and a half were found to be scarcely enough for this delightful task; and the labour required for its accomplishment was more than repaid by the rich harvest he reaped. At George's Drosdy the Hottentots were again exchanged, and the adjoining range of mountains ascended and examined, as it was at different times at other places. Mossel bay was next visited; and on the 6th of January 1815 he reached Zwellendám, where, by the authority of the Landdrost, a fresh party of Hottentots was obtained. Thence the road through Genadendal, the Nieuw Kloof, and Stellenbosh, conducted Mr. Burchell to Cape Town on the 13th of April, 1815.

During the whole journey of nearly four years, he never, except in three instances, slept in a house. The result of his

travels is an addition to the knowledge of a part of Africa not before explored, and an investigation of many parts already known, and made more at leisure than by former travellers, and under circumstances more favourable for permitting an undisguised view of their inhabitants: multiplied observations, both geographical and astronomical, from which a correct map of his track may be expected: above five hundred sketches and drawings, the subjects of which are landscapes, portraits, natural history, &c.: very large collections in natural history, comprising a hundred and twenty skins of quadrupeds, amongst which are a male and female camelopardalis, and many animals hitherto undescribed: five hundred and forty birds of two hundred and sixty-five different species: above seventy amphibia: about two thousand five hundred insects, the number of distinct species of which is not yet ascertained: an herbarium in particularly fine preservation, amounting to above forty thousand specimens, including the duplicates, the number of species contained in which is not at present known: geological and mineralogical specimens, &c.: together with various implements and dresses belonging to the natives.

We understand it is Mr. Burchell's intention to communicate the result of his labours to the public, giving the narrative part of his travels separate from that relating to natural history; which latter he intends to divide into distinct works, accompanied by figures of most of the subjects described.

ART. VIII. *An Account of a new Species of* AGAVE, *from the "Biblioteca Italiana." Milan,* 1816.

IN the number for last January of the Italian Journal with the above title, we find the history of an interesting and undescribed plant, which flowered in 1815, for the first time in Europe, after having been cultivated in various gardens on the Continent for at least twenty years past. The author of

the account is Signor Giuseppe Tagliabue, superintendent of the Duke of Litta's garden at Lainate, near Milan. He has made the plant the foundation of a new genus, to which he has affixed the name of his patron in whose garden it blossomed; and, as we think, has in this instance evinced more gratitude than botanical discernment. In our view, the plant is palpably an Agave, and not in want of a new generic establishment for its introduction into any general system. Indeed the only feature adduced by Signore Tagliabue to discriminate it from Agave, is, the turning or rolling back of the segments of the corolla. This very character, however, occurs in an established species of Agave, viz. the *yuccæfolia* of Redoutés Liliacées, see plates 328 and 329. But if the case had been otherwise, a feature of this nature could never serve, even during the present rage of reducing genera, singly and unaccompanied by any remarkable difference elsewhere, as the foundation of its separation from a genus with which it agreed in the other characters, especially while that genus was far from being overstocked with species. Signore Tagliabue has taken the pains in this account to tell us how his newly created Littæa may be distinguished from some other genera of older date, as *Lanaria*, *Aletris*, *Furcræa*, *Veltheimia*, *Hyacinthus*, *Sanseviera*, &c. with any of which, in our apprehension, it never could be in the slightest danger of being confounded.

The species is presumed to be native of South America, and to have found its way into Italy through Lisbon. The caudex or trunk of the specimen described was, in Milanese measures, a yard high and seven inches thick; the leaves about one yard long; the flower-stem eight yards and two inches high; the flowers, of which 1482 were counted, about an inch in depth. The technical description we shall subjoin nearly as we find it; adding the essential generic and specific characters, necessary on its transfer to its present place.

Class and Order.

Hexandria Monogynia.

Asphodeli. *Jussieu gen. plant.*

Generic Character.

AGAVE. *Cor.* 6-partita, erecta. *Filam.* corollâ longiora, erecta. *Antheræ* versatiles.

Specific Character and Synonyms.

AGAVE *geminiflora*, foliis margine filamentosis: spicæ floribus per paria approximatis. *Nobis.*

Littæa geminiflora. *Tagliabue in Bibliot. ital.* 1. 100—111.

Dracæna filamentosa. *Scannagatta.*

Yucca Boscii. *Desfontaines cat. mus. paris.*

Buonapartea juncea. *Schlectendahl suppl. ad enum. pl. hort. berol.* (*nec aliorum*).

Juncus foliis apice spinosis, et basi vaginantibus. *Hort. bonon. cat.* 1797.

The four last denominations were ascribed to the plant before the inflorescence was known.

Description.

Radix ramosa, paucis onusta radiculis flexuosis, colore obscuro.

Caudex erectus, teres, lævis, cicatricibus foliorum squamosus.

Folia (obscurè viridia) in orbem ad apicem caudicis congesta, sessilia, ancipitia, basi tantummodò incrassata, farcta, substriata, glabra, diffusa (flaccida), mucrone osseo terminata, marginibus per ætatem filamentosis.

Scapus centralis, simplex, erectus, teres, lævis, substriatus, infernè squamosus, squamis lanceolato-dentatis, supernè multiflorus floribus in (seriem) spiralem crebram interruptam dispositis.

Flores sessiles, geminati, in spicam longissimam digesti, bractea lineari-lanceolata subciliata florem subæquante suffulti, ochroleuco-viridi-violacei, basi cujusdam floris duabus aliis bracteolis ovatoacutis, ciliatis scariosis præditi.

Calyx o.

Corolla tubuloso-campanulata, sexangularis: limbus 6-fidus revolutus, laciniis lanceolatis.

Filamenta (purpurascentia) erecta, laciniarum limbi basi inserta, eoque duplo longiora. *Antheræ* (lutescentes) versatiles, magnæ, oblongæ, longitudinalitèr sulcatæ.

Germen inferum, ovatum, 6-gonum. *Stylus* erectus, simplex, teres, supernè crassior, corollâ paulò longior. *Stigma* inconspicuum.

Capsula polysperma, 3-gona. *Semina* duplici serie in singulo loculo, semiorbicularia, plana, nitida, nigra.

This plant has been cultivated in the English green-houses for several years past; but none of the specimens we have seen appear yet to approach the stage of growth at which they may be expected to flower. It has been generally mistaken for the BUONAPARTEA *juncea*, a very distinct vegetable, belonging to the natural order of *Bromeliæ*, and closely allied to TILLANDSIA. That flowered some years ago in the Royal Gardens at Kew, but it has not been inserted in the late edition of the catalogue of plants in them. It is a small plant with blue flowers of considerable beauty, named after the then First Consul of the French republic, by Messrs. Ruiz and Pavon, in their Flora Peruviana; where it is figured.

Explanation of Plate I.*

(*a.*) A part of the stem with unexpanded flowers one-third of the natural size, as are all the other parts which follow.

(*b.*) A part of the stem with expanded flowers.

(*c.*) A flower dissected vertically.

(*d.*) An unripe capsule dissected horizontally.

(*e.*) A ripe capsule entire.

(*f.*) A ripe capsule dissected horizontally.

(*g.*) The same dissected vertically.

(*h.*) Seeds.

(*i.*) An old leaf, with its filamentous margin.

N. B. The spike of flowers is represented less close than in nature for the sake of distinctness; a part of the foliage is also omitted, so that a portion of the scaly caudex may be seen.

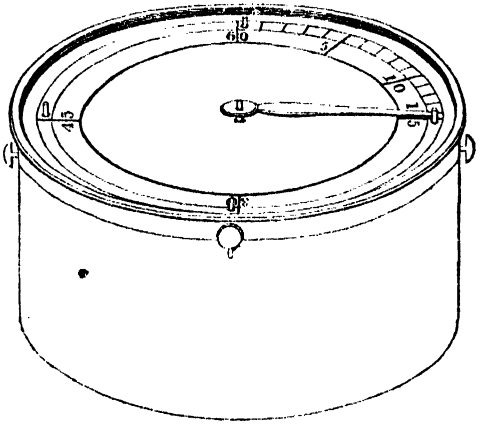
It is added in a note by Signore Tagliabue, that finding his plant, although old, shewed no symptoms of producing offsets or suckers; he bethought himself of searing the bud at the summit of the stem with a red hot iron, and thus stopping its

* On which the title of LITTÆA has been engraved instead of AGAVE.

growth in the only direction it had yet proceeded in. The consequence of his doing so was, that the wound soon healed and a brood of suckers was produced round the caudex, which were fit for removal from the parent plant in the space of three months afterwards.

We presume this was done to a plant that had not flowered; as the production of bloom in monocotyledonous plants of the nature of the present, is generally followed by a production of suckers, and often by the destruction of the trunk or caudex.

Art. IX. *Description of a new Machine to measure a Ship's Way by the Log-line. By Mr.* J. Newman.



The quarter and a half minute glasses in general use for measuring a ship's way, have always been found very irregular. This irregularity arises from various causes, and particularly the state of the atmosphere at different times and in various latitudes; and even, when they are new, it is scarcely possible to find two that will run out in the same time.

As the log-line is in general use for measuring a ship's way, it is evident that so inadequate a method of ascertaining the

portion of time required, must introduce many errors into the estimate made of the velocity and progress of the vessel, and a small, simple, and correct machine that can be depended upon for this purpose, appears to be a very desirable improvement.

A small machine which I have invented, and which has had the decided approbation of many naval officers, appears to possess every requisite for the purpose to which it is intended to be applied. It is inclosed in a round brass box $3\frac{1}{2}$ inches in diameter and $1\frac{1}{2}$ in depth. It has a dial, the circumference of which is divided into sixty parts. In the centre is an index, which is carried round by the machine once in 60″ or one minute. At the 15th, 30th, 45th, and 60th second are holes made in the dial, through which pins are pushed up or down by small buttons on the outside. The dial is covered in by a strong glass.

When the machine is used; being wound up, the index is to be retained at 60″ by putting the pin up at that division. If then 15″ are to be counted, the pin at 15″ is to be put up and the moment the log is delivered that at 60″ depressed; the index immediately advances and continues in motion until stopped at 15″. If 30, or 45, or 60 seconds are to be told, the pin belonging to the number required is to be put up and the time told as before.

The beats of the machine can be heard at a considerable distance; and the moment at which it stops so readily distinguished, that it may be used as well in a dark night as during day, or by a light; and as it is perfectly accurate, very strong and very portable, it seems well adapted to supply the place of that cargo of incorrect minute glasses at present taken out by vessels.

Art. X. *Some Account of the Alstenia Teiformis, or Tea of Bogota. Drawn up from the Journal of M.* Palacio-Faxar, *by* M. Faraday, *Assistant in the Laboratory of the Royal Institution.*

The Alstenia Teiformis, though known in Europe, has not yet excited all the attention it appears to deserve. Dr. Mutis has given a description of it, and of its uses, both as a medicine and a luxury. As the plant is hardy, and flourishes in cold climates, it may deserve attention as a substitute for the tea plant of China; for if the infusion of its leaves be found salutary, and perhaps in some respects preferable to that obtained from China tea, the cultivation of the plant might be undertaken in this country,* and enable us to procure that at home, for which we are now dependant on others.

"From Merida of Maracaybo (M. Palacio says) I went to Barinas, by Los Callexones, and having ascended the Paramo of Mucuchies, where reigns a perpetual frost, I descended gradually to Las Piedras, through a road covered with Espelezia, Stellaria, and Gentiana. The Callexones is a road through a ridge of rugged mountains, which extends as far as Barinitas. In travelling on this road, especially on the mountain called Lacamacho, and in the height of from 1500 to 1700 fathoms above the level of the sea, I perceived an odoriferous scent, which my fellow travellers assured me was produced by a shrub, known in the country by the name of Albricias, and that it was used to perfume the churches on festival days, by strewing them with fresh leaves of it: I then recognised it to be the Alstenia Teiformis, or Tea of Bogota, described by Dr. Mutis."

Some of the leaves were collected. Portions were dried in the sun, and also upon heated porcelain plates. Those dried in the sun made the strongest infusion, but did not differ from the others in any of their general properties.

* M. Palacio-Faxar would send plants of the Tea of Bogota to England, should any person be desirous to cultivate them.

A table spoonful of the bruised leaves with a pint of water produced an infusion of a yellow green colour, of an aromatic smell and pleasant taste, and requiring but little sugar to make it sweet. It was refreshing, agreeable to the palate, and encreased the perspiration. A second portion of water being poured on the same leaves, an infusion clearer than the former was produced, but still possessing an agreeable taste and smell. The latter is the infusion prescribed by Dr. Mutis, as being very salutary, if taken as a drink at breakfast and supper. The stronger infusion is recommended in cases where sudorifics and cordials are prescribed. A third portion of water formed a tea still very pleasant, and possessing much of the peculiar taste and flavour of the leaves.

The dried leaves reduced to a powder are applied, in the country where the plant is found, as a remedy for cold in the head, and which is used as snuff, and causes sneezing.

By distilling three table-spoonfuls of the leaves, in four pints of common water, above a pint of highly perfumed liquor was obtained. The rest of the water being poured from the leaves was evaporated, and left a solid substance, having a strong astringent taste, but no smell. Five drachms of the leaves being infused in alcohol, and the liquid evaporated, a blackish resinous substance was obtained, pungent and astringent, keeping its perfume, burning with a bright flame, and when taken into the mouth, colouring the spittle green.

A few experiments were made on some of the leaves of this plant, sent by M. Palacio Faxar to the Royal Institution. Four hundred and eighty grains were digested in repeated portions of alcohol until nothing more appeared to be taken up. The leaves, when dried, had lost nearly all taste, and had no smell; they weighed only 320 grains. The alcohol whilst cooling, deposited many flocculi; these were separated on a filter and formed a dark green substance. It fused by heat, passing into the pores of the paper: it gave way under pressure, and possessed the smell, lustre, and other properties of

wax; which substance it appeared to be, mixed with a little extract. The weight of the filter had increased eight grains.

The cold alcoholic solution was of a fine green colour; it precipitated salts of iron black, and threw down a precipitate with jelly much more abundant than that produced by alcohol alone. It precipitated with ether, and with water, exhibiting the presence of extract and of resin. Evaporated to dryness, it yielded eighty-two grains of a solid dark green substance; much of this appeared to be wax deposited, as the quantity of alcohol diminished. The re-addition of alcohol in small quantities formed a turbid solution, in larger quantities a clear one, precipitable by re-agents as before.

Four hundred and eighty grains of the leaves boiled in repeated portions of water, were dried; they had neither taste nor smell, and weighed 270 grains only. The decoction precipitated salts of iron and solution of gelatine. It was of a dull green colour, and of a strong aromatic taste and flavour. Evaporated to dryness, it weighed 144 grains.

Art. XI. *Historical Notice of the Life and Writings of* D. Dolomieu. *By the Count* Lacepede.

Deodat-Guy-Silvain Tancrede de Dolomieu was born on the 24th of June 1750. From his infancy he was admittted a member of the religious order of Malta; at about the age of eighteen, whilst serving on board one of the gallies of the Knights of Malta, he was unfortunately so circumstanced as, in his opinion, to be compelled to resent an insult which had been offered to him by one of his companions in arms. His adversary fell. Although universally beloved, no interference of the knights was able to protect him from the severity of the laws of the order; the statutes directing the infliction of the severest punishment against those who during the period of their military service, should use their arms against any other than the general enemies of Christianity. He was therefore condemned to die, but received his pardon

from the Grand Master. This pardon, nevertheless, it was necessary should be confirmed by the Pope; and he, from some ancient prejudices against the order, was unwilling to interfere in the behalf of one of its members, and the pardon was refused. Many of the Powers of Europe interceded with Clement XIII. in his favour, but he remained inflexible; and Dolomieu continued in captivity for nine months; when a letter, which he had addressed to the Cardinal Torregiani, the Prime Minister at Rome, procured him that which had been so often refused to such illustrious applicants. He was released from prison, and completely reinstated in his former rank and privileges.

But he was now become, as it were, a new man. The solitude of his prison, the silence with which he had been surrounded, the necessity of dispelling his grief and inquietude by occupation, had induced the habit of deep meditation. He retraced his early studies, and busied himself in the acquirement of knowledge. For some time, it seems, he hesitated, whether to devote himself to the study of natural history, or to classical literature; but at length decided in favour of the former, though his taste for letters continued through life. At the age of 22 he joined at Metz the regiment of Carbineers, to which he had been appointed at 15; during his stay there, he particularly attracted the notice and friendship of Thirion, a physician, whose lectures on chemistry and natural history he was then attending, by some spirited exertions in extinguishing a fire which took place in one of the military hospitals. It was about the commencement of this acquaintance that he translated into Italian, Bergman on Volcanic Substances; to which work, and also to an Italian translation of Cronsted's Mineralogy, he added notes.

About this period Dolomieu formed a friendship with the celebrated and unfortunate La Rochefoucault, which ceased but with his existence. Beside the inquiry respecting the weight of bodies at different distances from the centre of the earth, which was published in 1775, he had already prepared several works. These were seen by La Rochefoucault; and

he recognized in them the mind of one destined, at no very distant period, to become a very distinguished naturalist; and it was on his report to the Academy of Science on his return to Paris, that Dolomieu was elected a corresponding member.

On the reception of this distinction, the more pleasing because unexpected, Dolomieu conceived himself bound by a fresh tie to the pursuit of natural philosophy; and that he might devote himself to it without interruption, gave up his commission in the Carbineers, wholly abandoning the military profession.

Thus at full liberty to indulge his secret inclinations, he commenced his mineralogical travels, intending to visit the Island of Malta, and all the celebrated countries on the shores of the Mediterranean. His first journey was to Sicily.

He was now but twenty-six. Animated by the eagerness of study, and in the full vigour of youth, his first labour was the minute examination of Mount Etna and its environs, carefully observing the strata, &c.; he afterwards made several journies to Mount Vesuvius, and the Appenines, and the surrounding countries. After this he visited the greater part of the Alps, noticing with great care their different structures and component parts. In 1783 he published a description of the Lipari islands, which he had also visited.

In this year a violent earthquake happened in Calabria, in consequence of which a vast number of persons lost their lives. Dolomieu eagerly hastened to the spot, in order to examine the particular circumstances attending this catastrophe; and in 1784 published a work, containing not only his observations on this particular phænomenon, but some remarks on the effects of earthquakes in general, in which he incontestably proves that in the part of Calabria, where the greatest ravages had taken place, the mountains were all calcareous, without any appearance of volcanic matter. In 1788, he published a Memoir on the Ponticen island, and also a Catalogue Raisonné of the Volcanic Specimens he had collected on Mount Etna.

In the beginning of the Revolution, he hastened to his

native country, and early ranged himself on the side of liberty; but as he was not nominated to any public employment, he continued unremittingly to apply to his studies, and during the first years of the revolution, published several works: one on the Origin of Basalt. A second on a species of Calcarious Stones, which had never been before remarked, and to which earth, naturalists have since, in honour of him, given the name of *Dolomite.* Two others on Rocks and *Compound* Stones. A fifth on the Oil of Petroleum, and the Elastic Fluids extracted from quartz. Whilst he was employed in these pursuits, his studies were interrupted by the persecution of his friend La Rochefoucault, who was attacked by some of the revolutionary assassins, and expired in his arms. Dolomieu, who had made himself conspicuous by the defence of his friend, was now proscribed in turn, and being compelled to wander from one place of concealment to another, had little leisure to devote to the pursuit of Science; nevertheless he published two memoirs during this period; one on the *figured stones* of Florence, the other of the physical constitution of Egypt: in the latter work he had the boldness to express his sorrow for the death of his friend, and to denounce his assassination, though the authors of it still maintained their power.

But towards the third year of the foundation of the French Republic, tranquillity and national glory began to succeed the revolutionary storms which had so long raged: Dolomieu was included in the "Ecoles des Mines," then established; and he printed in the journals several memoirs on the component parts of volcanic mountains. About the same period the National Institute of Science and Arts was founded, of which he was one of the original members. In less than three years this indefatigable author published twenty-seven original memoirs, the principal subjects of which, were the nature of Leucite, its origin, and the circumstances under which it is found; the Peridot, which had been analyzed by Vauquelin, compared with the *Chrysolite* of Werner; the *Anthrakite*; the volcanic *schorl* named *Pyroxene*; the geology of the mountains of Vosges; the necessity of the union of

chemical with mineralogical knowledge; colour considered as a character of stones; on the heat of lava; on the necessary principles in the distribution of the nomenclature of rocks; the definition of the limits of mineralogy, mineral chemistry, geology, and mining. He undertook a new journey into the south of France, and the Alps: he proceeded step by step, his hammer in his hand, through the country which the Allier and Rhone passes; he traced that vast chain of alps which stretches from the Isere to the Valteline; and particularly examining the famous valley called Allier Blanche and Mont Rose, the gigantic rival of Mont Blanc, he revisited the Lago Maggiore, St. Gothard, the Valais, and returned for the fifth time by Mont Blanc, illustrious by the residence of his friend, the celebrated Saussure.

After an absence of six months he returned to Paris with an immense collection of specimens. He printed the report which he made to the Institute, which alone is sufficient to have formed the reputation of a naturalist; in which all the particular facts which he observed are detailed, together with the general results of his observations. The most important of his remarks are these on the formation of volcanic mountains. "God alone knows," says he, at the close of the report, "if my whole life will be long enough for the different researches which I propose to make."

Some time after this Dolomieu commenced an extensive work on mineralogy, which was intended to be inserted in the "*Encyclopédie Methodique.*" When the conquest of Egypt was undertaken by Buonaparte, he was one of the many men of science who were selected to accompany this singular expedition. On the French fleet arriving off Malta, Dolomieu, who till then was ignorant that the expedition was to commence with the capture of this island, was sensibly grieved, and entirely confined himself to his ship. The Grand Master hearing that he was in the fleet, used every endeavour to have him named one of the negociators; and he was accordingly selected by the commander in chief, and commissioned to be the bearer of the proposals for surrender to his former companions in arms. On the island being ceded to

the French, he was unceasing in endeavours to serve the members of the Order, and more especially those who, during the time of former dissensions, had been marked by hostility towards him. Such was the generosity and the delicacy of his conduct, that one of the grand officers of the order (de Loras) who had been one of his most strenuous antagonists, declared to him that he should never cease to reproach himself for his former injustice.

On the arrival of the expedition in Egypt, he visited Alexandria, the Delta, Cairo, the Pyramids, and a part of the mountains which bound the valley of the Nile; he next proposed to explore the different chains formed by these mountains, and to examine that part of the basin of the Mediterranean which he now beheld for the first time; to penetrate as far as the Arabian Gulph, from thence beyond the cataracts of the Nile, and to traverse the deserts of Lybia; but different untoward circumstances concurred in preventing his carrying this plan into execution, and after a short time his health became so deranged, that he was compelled to return to Europe.

On the day after his departure from Alexandria, the ship, which was overtaken by a violent storm, sprung a leak, and but for the exertions of an old Neapolitan pilot, would have foundered. They were at length driven into the gulph of Tarentum, and just reached the port as the ship was sinking. On the day following one of the sailors on board died of the plague; but a more imminent danger awaited them; the counter-revolution had just taken place, the French were all made prisoners, and conducted, amidst the execrations and threats of an enraged populace, to a miserable dungeon, where Dolomieu, his friend Cordier the mineralogist, and General Manscour were confined, together with fifty three of their countrymen.

The populace of Tarentum several times surrounded the prison, for the purpose of immolating the prisoners, but they were restrained by the persuasions of a Corsican emigrant, who frequently exposed his own life in the protection of the French.

After they had remained eighteen days in confinement, the victorious legions of the republican army entered the town; the French prisoners were of course immediately released and transferred to a spacious mansion, and every assistance afforded them. But these troops being recalled, the danger of the prisoners became far greater than ever. Dolomieu continued, nevertheless, to make extracts from Pliny, for a work he was preparing, and discoursing with his companions on subjects of natural history. When the prisoners were embarked for Sicily, from whence they were to be sent to France, they were plundered of all they possessed; Dolomieu lost both his collections and his manuscripts; and three days after the French arrived at Messina, he learnt that he had been expressly denounced by the government. The remembrance of the ancient disputes which had formerly existed amongst the members of the Order of Malta, still rankled in the breasts of some who were his enemies, whose minds were now agitated by every angry feeling, on account of the revolutionary events which had taken place. Dolomieu was singled out to be the unfortunate victim of these ungovernable and unjust passions; and he at once foresaw the misfortunes which awaited him. The peril increased with each hour's delay. Along side of the ship in which the French were confined, there was a small Maltese vessel, and it was proposed that he should seize this, and attempt to escape; but as it would have been necessary to have killed the centinel, had he resisted, Dolomieu, it is said, refused to save himself at the risque of sacrificing the life of another. He delivered to his pupil Cordier his letters to his friends, together with some valuable observations on the level of the Mediterranean, which he put together with as much tranquillity as if he had been at full liberty, and embracing his companions, from whom he was about to be separated, and without any appearance either of weakness or of ostentation, surrendered himself into the hands of the satellites who had come to drag him away from his countrymen, whose feelings may be well supposed at finding themselves unable to succour him

He was confined in a dungeon, lighted only by one small

opening, which with barbarous precaution was closely shut every night. He continued confined without any assistance, or hearing from any one; and his jailor, by the reports he from time to time made to him of the ill success of the republican arms, deprived him of this last remaining hope of succour. The heat, and the small quantity of fresh air admitted by the window of his prison, compelled him to spend nearly the whole of his time in fanning himself with the few tattered remnants of clothes, in order to increase the circulation of the air.

Meanwhile Cordier had reached France with his letters. The news of his misfortunes soon spread throughout Europe. The French Government lost not a moment in making the most urgent demands for the liberty of one who had reflected so much credit on his country. To these were added, the solicitations of the Royal Society, and of Sir Joseph Banks. The Danes wrote, desiring their Minister to render him whatever pecuniary assistance might be requisite; and Mr. Predbend, an Englishman resident at Messina, afforded all the assistance in his power; M. D'Azara, the illustrious patron of the arts, who for many years had been allied to Dolomieu by the closest ties of friendship, was unremitting in his zealous efforts to second the attempts of his relations for his release. The King of Spain twice wrote in his favour; but he still continued to languish in prison, ignorant even of the news of his misfortunes having reached those whom he loved best.

During these vain attempts in his favour, Daubenton died, and the situation he held in the Museum of Natural History became vacant. Haüy and Dolomieu were both named by the public voice as worthy to succeed him; but Dolomieu was in confinement and misfortune, and he was chosen by the Professors without hesitation.

Shortly after this, the astonishing campaign which terminated by the victory of Marengo, completely established the French republic. Buonaparte made peace with Naples; and it will be long recorded in the annals of science, that the *first* article of the treaty was a stipulation for the immediate deliverance of Dolomieu.

His return amidst his countrymen, his companions, and

friends, was celebrated as a sort of triumph of literature. Soon after he delivered at the Museum of Natural History a Course of Lectures on the Philosophy of Mineralogy: but in a short time he again quitted Paris to revisit his *beloved mountains*, as he called the Alps. He performed the journey in company with M. Neergaard, a learned Dane, who afterwards published a very interesting account of it.

He visited the highest summits of the parts surrounding St. Bernard, the part rendered famous by the passage of a second Hannibal, the Gemmi, the wonderful road across the Simplon, the valley of Tessin, the passage of Dissentis, and the Glaciers of the Geisner mountains.

On quitting these primitive rocks, Dolomieu, viewed them for some time in a sort of enthusiastic silence; and with a melancholy presentiment that he saw them for the last time, bade them a long and melancholy farewell.

He returned to Lyons by Lucerne, the Glaciers of Grindelwald, Geneva, the country of his parents, and where he was received with every mark of affection and respect by those with whom he had passed his childhood. From thence he went to Chateauneuf, to visit a sister whom he loved, and his brother-in-law, (de Drée) who had a very considerable knowledge of mineralogy, and was possessed of one of the best private collections of minerals. Here he again occupied himself, with a design he had long entertained of adding to his vast store of geological knowledge, by two extensive journies, the first through Germany, and the second through Denmark, Norway, and Sweden: and he proposed to publish the work which he had planned in his prison at Messina, of which he printed a fragment.

This fragment is on "*Mineral Species*," and is at once a monument of his genius and his misfortunes, being written in his dungeon in Sicily, on the margin of a few books which his gaoler had left him, with the black of his lamp smoke mixed with water for ink, and a bone sharpened against his prison walls for a pen.

From this work it appears how much the progress of mineralogy has been retarded by want of a fixed rule for the ascer-

taining the species of minerals; and the author proposes that the *integral molecule* shall be regarded as the principle by which the species is to be determined, and that no other specific characters should be admitted, than those which result from the composition or form of the integral molecule.

The progress, however, of Dolomieu in the pursuit of knowledge was suddenly arrested; and at a time when his health and habits promised an extensive duration of existence. Whilst at Chateauneuf he was attacked by a disorder which carried him to an early grave. He expired in the arms of his sister, and his brother Alphonso Dolomieu, and of the brother of his intimate friend Le Metherie, the naturalist.

We have extracted the foregoing narative from the *Eloge* of Lacepede, omitting however the ornamental and declamatory parts, which form so very considerable a portion of the French productions of this nature.

With regard to the last work of Dolomieu, on the Mineral Species, it will be readily admitted that an accurate and competent distinction had not been laid down in the science of mineralogy; but the proposal of founding these distinctions on the integral molecule, however philosophical it may appear in theory, is liable to the objection, that the integral molecule is not always easily detected, or easily characterised; but it is fair to infer, that the same genius which inspired this masterly and eloquent fragment of an original system, under peculiar circumstances of vexation and discomfort, would, in happier hours, have devised methods of obviating practical difficulties.

We do not conceive it necessary to apologize to our readers for continuing these Biographical Notices. All are desirous of being informed of whatever relates to the life of any one, who by his works or discoveries, has contributed to the advancement of science. This species of history, whilst it gratifies curiosity, presents models for study and imitation, indicating what has been perfected, and what remains to be done. In tracing the history of one who has devoted himself to science,

in order that it may be rendered useful and interesting in the fullest extent, it is not enough, however, that a general view of his works, with a summary of his habits and general character is given; it should go further, and point out the means by which truth was attained, the use made of the opportunities afforded by chance, and how, and what obstacles were surmounted in the pursuit of knowledge; details of this kind however are rarely to be procured from authentic sources, and deprived of them, we are often induced to put together such prominent traits in the lives of celebrated personages as can be procured, to serve at once as a tribute to their memories, and to prevent a chasm in the history of science; such motives as these have instigated several learned bodies to record the lives of their members; a kind of biography in France, that has been particularly cultivated, and set apart under the title of *Eloges*, and to which we have hitherto been indebted.

Art. XII. *Account of some Experiments made with* Newman's Blow-pipe, *by inflaming a highly condensed Mixture of the gaseous Constituents of* Water; *in a Letter to the Editor, from* Edward Daniel Clarke, *LL. D. Professor of Mineralogy in the University of Cambridge.*

Sir,

If the chemists of former ages had been told that to encrease the action of *fire* it is necessary that the combustible be *water*, some such author as *Agricola*, or *Bernard Cæsius*, in his chapter "*de Aquarum miraculis*," would perhaps have maintained that this truth was mystically typified in the rape of *Proserpine*, by *Pluto*, from the fountain of *Cyane*. This wonderful property in the constituents of *water* is however now so well known, that it may serve to illustrate some remarkable phænomena of fusion in volcanoes, whose apertures, ejecting torrents of liquid rocks, are, in fact, so many *blow-pipes* upon a large scale; whence mixed *gases*, which have resulted from the

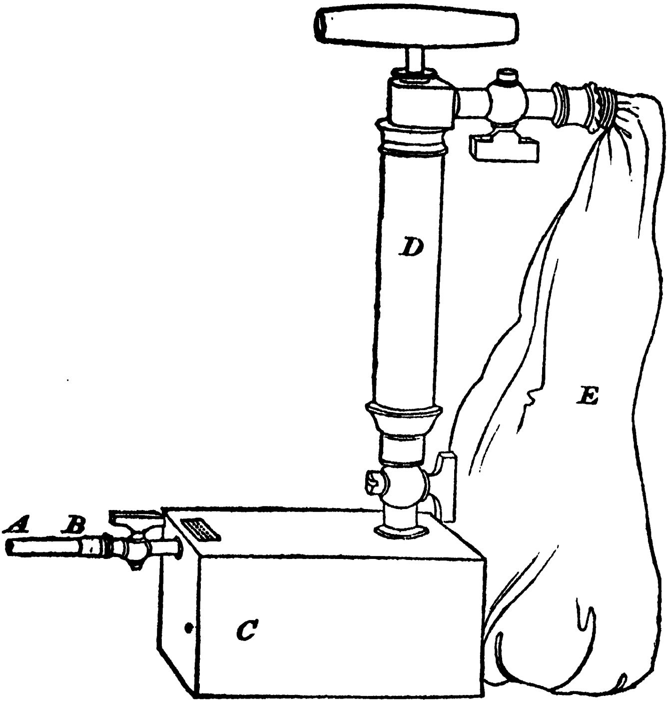
decomposition of *sea-water*, and which have undergone the utmost *compression*, make their escape in a state of *ignition*.

Of the power of heat produced by burning together *hydrogen* and *oxygen gases*, every one has been aware who has attended to the experiments for the composition of *water*.* Having occasion to allude to the temperature thereby excited, during the last Course of my Public Lectures in this University, and with reference to observations that I had myself made upon Mount *Vesuvius*, I used an apparatus adapted to the blow-pipe made by Mr. *John Newman*, the construction of which was explained by Mr. *Newman* himself, in a communication to the first Number of your Journal.† Upon this occasion the flame of a common *spirit* lamp was propelled by a stream of condensed *oxygen* from the reservoir of the *apparatus*: but the *hydrogen* from the *alcohol* not being afforded in the proper proportion for producing the greatest heat, I consulted Mr. *Newman* upon the subject, who recommended that a condensed mixture of the two *gases* should be ignited instead of the *spirit* lamp. The danger of such an experiment with an explosive mixture, was obvious: several eminent chemists considered it as extremely hazardous; but it was suggested by Mr. *Newman*, that upon the principle of *Sir H. Davy's* wire-gauze safe-lamp, there would be no danger if the mixed gases, previously to their ignition, were made to pass through a capillary tube. Upon this I applied to *Sir H. Davy*, and requested to have his opinion. He replied, that he had tried the experiment, and

* The first application of these *gases* to aid the operations of the *blow-pipe* was made in 1802, by an Amerian, *Robert Hare*, jun. Professor of Natural Philosophy in the University of Philadelphia. (*See Bruce's American Mineralogical Journal*, *Vol. I. No.* 2. *p.* 97, *Note*). An account of Mr. *Hare's* experiments also appeared in the *Annales de Chimie*, No. 134. entitled *Mémoire sur l' usage du Chalumeau, et les Moyens de l'alimenter d' Air*, &c. The first usage of the *gases* in a state of mixture from a common reservoir was made by an unknown native of Germany.

† See No. I. Art. VII. p. 65. Also *Thomson's Annals* for May 1816, p. 367. It was first exhibited in *Cambridge* by the Rev. Mr. *Powell*, of Trinity College, during a Course of Lectures upon the Chemistry of Agriculture.

that he was convinced "there would be no danger in burning the compressed gases by suffering them to pass through a fine thermometer tube, $\frac{1}{80}$ of an inch diameter and three inches in length." In consequence of this encouragement I obtained from Mr. *Newman* the necessary apparatus* and



began a course of experiments, which have already been attended with some curious results. These experiments were made in the presence of the Rev. Mr. *Cumming*, our Professor of Chemistry, who kindly supplied me with whatever chemical apparatus was required; the Rev. *J. Holmes*, well

* See the annexed wood-cut.

A. B. is the *glass-tube*.

C. The *Reservoir* for the condensed gas.

D. The *Piston* for condensation.

E. The *Bladder* holding the gaseous mixture previously to its condensation.

known for his analytical researches; Dr. *Ingle*, and other members of this University. As these gentlemen were not always all of them with me at once, nor the experiments all made at the same time, I shall, in stating them, attend only to the order in which they occurred, without mentioning the precise day when they were exhibited, or the names of the persons who were present.

Having exhausted the reservoir of the *blow-pipe* C, of atmospheric air, a *gaseous* mixture was introduced, and as highly condensed, as possible, by means of the piston D, consisting of two parts by bulk of *hydrogen* and one part of *oxygen*;* which in all the following experiments I have found to afford, when ignited, the greatest degree of heat. A portion of this mixture being allowed to pass through the orifice of the *blow-pipe* was ignited at the extremity of the glass tube A, B.; and such was its exalted temperature, that, as the sequel will prove, it has banished altogether the character of *infusibility* from the list of chemical tests to which minerals may be exposed. I cannot believe that this temperature has yet been exceeded by that of any apparatus hitherto employed. *Platinum* was not only fused the instant it was brought into contact with the flame of the ignited *gas*, but the melted metal ran down in drops. Some of these drops, which fell from a wire of *platinum* $\frac{1}{20}$ of an inch in diameter, weighed five grains. But the rapid fusion of *platinum* was not the only remarkable circumstance attending this experiment; it was accompanied by the combustion of the metal itself; which caught fire and continued to burn like *iron* wire in *oxygen gas*, with a vivid and beautiful scintillation. Afterwards we found that we were thus deprived of a valuable

* The intensity of the heat depends greatly upon the purity, as well as exact proportion of the two *gases*. The *oxygen* obtained from *manganese*, does not cause any thing like the heat which is occasioned by mixing with *hydrogen*, the *oxygen* produced from the *hyper-oxymuriate* of *potass*. The *light* produced during the combustion of the *gaseous* mixture is, in the latter instance, fully as intense as that which is occasioned by burning *charcoal* with the aid of the most powerful *galvanic* battery.

means of supporting less fusible substances, when we wished to expose them to the action of the flame; a small but stout crucible of *platinum* being incapable of sustaining the heat without becoming ignited, and fusing, as in the former instance.

Our next experiments were made with *palladium*. This metal became fused with greater rapidity than the *platinum*. It melted before the flame like *lead*; and beginning to burn, exhibited sparks of a fiery red colour diverging from the focus in brilliant rays. The metal after fusion had a dull aspect, its surface being irregular and tarnished, like *pewter* that has been long exposed to the air of the atmosphere. A singular effect of heat was observed upon a polished lamina of *palladium*; instead of the blue colour usually given to this metal, by flame, when urged by the common blow-pipe, a beautiful *spectrum* appeared, displaying all the hues of the rainbow, and in the same order.

These experiments had taken place when we began to make trials of the *earths*. We began with *lime*, exposing to the flame a small portion of this *earth* in its greatest purity. It was supported in a cup, or crucible, which Professor *Cumming* had prepared by twisting spirally some *platinum* wire of the thickness already mentioned. This was no sooner exposed to the action of the ignited *gas*, than the vivid combustion and fusion of the *platinum* gave us reason to apprehend that the *lime* would disappear among the melted metal; it was however obtained in a state of evident fusion, its upper surface being covered with a limpid botryoïdal vitreous appearance somewhat resembling *hyalite*; the inferior surface, owing to a cause we have not ascertained, was quite black;* and the whole, when examined with a lens, appeared studded over with exceeding minute globules of *platinum*. In a second trial which we made with *lime*, some of the globules of the vitrified *earth* were of a wax-yellow colour; the *platinum* melting among it as before. A lambent *purple* flame always accompanies the fusion of *lime*.

* Possibly owing to the presence of a small portion of *carbonic acid* retained by the *lime*, and which may have been decomposed.

Having thus succeeded in the fusion of pure *lime*, our next experiments were made with *magnesia*, and this *earth* became repeatedly fused; the fused mass in the several trials exhibiting either a porous glass, so light as to be driven off by the action of the *gas*, or else globules of a fine amber colour. The last happens when *magnesia* is supported by *pipe-clay*; the *clay* fusing with it upon *charcoal*; the *magnesia* after being mixed with *oil*, was reduced to a *slag*, which fell into a white powder again, and seems therefore to be *metallic*. The fusion of *magnesia* is attended by combustion, and the same coloured flame as *lime* and *strontian*.

We now began with *barytes*. The fusion in this instance was comparatively easy. The *barytes* was supported upon a crucible of *platinum*. It soon became fused, and exhibited a dingy metallic slag, looking like *lead*; but after a short exposure to the air it became covered with a whitish powder, and was restored again to the state of an *earthy* oxide.

Strontian was then exposed to the same test; when a partial combustion of the *earth* ensued, accompanied by a beautiful lambent flame of an intense amethystine colour; but the fusion here was slow and difficult. At last, after some minutes of exposure to the utmost heat of the *ignited gas*, there appeared a small oblong mass of shining metal in the centre of the *strontian*, (the rest being semi-fused) which Professor *Cumming*, owing to the lustre, suspected to be *platinum*; this, however, after being exposed to the air for a few minutes again assumed a white *earthy* appearance.*

Silex and *alumine* were next brought under the action of the *blow-pipe*. The first became instantly fused, and exhibited a deep orange-coloured glass, which upon continuing the heat seemed to be partly volatilized, leaving a pale yellow

* It is necessary to remark here that the *metallic* appearances both in the instance of *barytes* and of *strontian*, were in all probability due to the *platinum* used as a support, although derived from the *metals* of these *earths*, exhibited in a state of alloy; because when *strontian* was subsequently fused in a crucible of pure *plumbago*, it was converted into a porous vitrified *slag*, of a dingy greenish colour inclining to yellow.

transparent glass upon the *platinum*, which diffused itself in a thin superficies over the metal. The *alumine* was also melted with greater rapidity, into globules of a yellowish transparent glass. In these experiments with the *earths* some changes were effected in the *platinum* used as a supporter, which ought to be noticed. When *lime*, *magnesia*, *barytes* or *strontian*, were melted upon *platinum*, this metal was deprived of its lustre, and its surface becoming tarnished, appeared to be covered with a thin scaly superficies resembling the *amalgams*, either of *mercury* with *silver*, or of *mercury* with *tin*; but when *silex* or *alumine* were fused, no alteration of the *platinum* was observed. Owing to these changes in the *platinum*, and also to its constant fusion and combustion during these experiments, I substituted a small crucible of very pure *carburet* of *iron* from the *Borrowdale* mine, and again exposed pure *lime* to the flame of the ignited *gas*. Nearly the same result was, however, obtained; the *lime* became fused; its upper surface exhibiting limpid transparent globules of glass; the only difference in the experiment being, that an evident combustion took place during the utmost intensity of the heat.

Afterwards the *alkalies* were severally submitted to the same test; but their fusion, and subsequent volatilization took place with such rapidity that they disappeared almost in the same instant that they came into contact with the flame.

The most infusible of the substances considered as *simple*, being thus proved to be incapable of resisting the action of such a fire, we made trials of the most refractory of the native *compounds*; and the following statement of the results obtained has been made perhaps with as much brevity as the nature of the subject will admit.

1. *Rock crystal.* In the first trial the edges only were fused, and resembled *hyalite*. In the second trial the fusion was complete: the crystal appeared in the form of one of *Prince Rupert's Drops*; having lost nothing of its transparency, but being full of bubbles.
2. *Common white quartz.* The same appearance after fusion as the *rock crystal*.

3 *Noble-opal.* Pearl-white enamel; fusion perfect. The *opal*, after fusion, has great resemblance to the stalactitic *siliceous pearl* of *Tuscany*.

4. *Flint.* A snow white frothy enamel; fusion perfect, and very rapid.

5. *Chalcedony.* A snow-white enamel; fusion perfect.

6. *Egyptian Jasper.* This substance contains so much water, that the decrepitation, even of its smallest particles, causes its dispersion when presented to the flame. To prepare it therefore for the action of the blow-pipe, Professor *Cumming* exposed it to a strong heat in a covered *platinum* crucible; afterwards the particles were easily fused into a greenish glass full of bubbles.

7. *Zircon.* Becomes opake and of a white colour; its superficies only being fused, and exhibiting a white enamel like porcelain.

8. *Spinelle.* Fuses readily and undergoes partial combustion, with loss of colour and weight. One of the solid angles of an octahedral crystal was entirely burned off and disappeared.

9. *Sapphire.* A fine dodecahedral crystal of blue *sapphire* exhibited during fusion, the singular appearance of greenish glass *balloons*, swelling out in grotesque forms, which remained fixed when the mineral became cool.

10. *Topaz.* A white enamel covered with minute bubbles.

11. *Cymophane.* Pearl-white enamel.

12. *Pycnite.* Snow-white enamel.

13. *Andalusite.* Snow-white enamel.

14. *Wavellite.* Snow-white enamel.

15. *Rubellite*, or *red Siberian Tourmaline.* Loss of colour—a white opake enamel; by continuing the heat, a limpid colourless glass.

16. *Hyperstene.* Jet black shining glass bead, with a high degree of lustre.

17. *Cyanite.* Snow-white frothy enamel; fuses very readily.

18. *Talc.* The purest foliated varieties of this mineral were fused, and exhibited a greenish glass.

19. *Serpentine.* Many different varieties of *Serpentine* were

fused, and exhibited globules of an oak-apple green colour with an indented surface.

20. *Hyalite.* A snow-white frothy enamel, full of brilliant limpid bubbles. The specimens fused were selected from masses highly diaphanous, which invested the surface of decomposing *trap*.

21. *Lazulite.* Fused into a transparent and almost colourless glass slightly tinged green, and full of bubbles.

22. *Gadolinite.* Fused quickly, and exhibited a jet black shining glass with a high degree of lustre.

23. *Leucite.* Fused into a perfectly limpid colourless glass containing bubbles.

24. *Apatite* of *Estramadura.* This substance was fused into a white enamel resembling spermaceti in appearance. Some pure sparry *apatite* detached from a matrix of *magnetic iron* as found in *Lapland*, was fused into a chocolate brown glass, and became magnetic, owing to the iron; to which its colour was also due.

25. *Peruvian emerald.* Fused readily into a round bead of the most beautiful limpid glass without bubbles; having entirely lost its *green* colour, and resembling white *sapphire*.

26. *Siberian beryl.* This substance is often infusible with a common blow-pipe. It fused into a limpid glass containing bubbles.

27. *Potstone.* Fused very readily with combustion, exhibiting a remarkable appearance. The fused mass appeared as glass of a dingy walnut green colour, almost black; but when examined with a lens all the rest of the mass exhibited limpid needle-form crystals, highly transparent.

28. *Hydrate of Magnesia*, or *pure foliated magnesia* from *America.* This substance is more difficult of fusion than any other. I succeeded, however, with the utmost intensity of the heat, in reducing it to a white opake enamel, which was invested with a thin superficies of limpid glass. Its fusion was accompaniied with a purple coloured flame.

29. *Sub-sulphate of alumine.* This substance admits of a very rapid fusion, into a pearl white translucid enamel. Its fusion is also accompanied by a partial combustion.

30. *Pagodite of China.* Readily fuses into a beautiful limpid colourless glass bead; exhibiting a high degree of lustre.

31. *Iceland spar.* Perfect fusion into a brilliant limpid glass, but with greater difficulty than any other substance excepting the *hydrate* of *magnesia.* During the experiment a beautiful lambent flame, of a deep amethystine hue, exactly resembling that from *strontian*, was exhibited; denoting the combustion of some substance: and this remarkable phænomenon characterizes the fusion of pure *lime* and all its compounds.

32. *Common chalk.* Fusion into a yellowish grey enamel. By continuing the heat a clear pearly glass was obtained, resembling the *Silicious pearl* of *Tuscany.* The same purple flame appeared, as in the preceding experiment with *Iceland spar.*

33. *Arragonite.* Same fusion as pure *lime*; but difficult to obtain, owing to the crumbling disposition of the mineral when exposed to heat. Its fusion was accompanied by the *purple* flame as in that of pure *lime* and of *strontian.*

Combustion of the Diamond.

This experiment having often taken place at an inferior degree of temperature, was hardly necessary; but it was thought that a correct statement of the different appearances exhibited by the *diamond* during its combustion, might be interesting. We selected a fine octahedral diamond of an amber colour, weighing six carats.

At the first application of the extreme heat it became limpid and colourless; afterwards it appeared of a pale white colour; then it became quite opake and resembled *ivory*, being now diminished in bulk and weight. After this, one of the solid angles of the *octahedron* disappeared, and the surface of the *diamond* became covered with bubbles; next, all the

solid angles were burned off, and there remained only a minute spheroïdal globule shining with a considerable degree of *metallic lustre;* lastly, every atom was volatilized; the whole experiment being completed in about three minutes.

Experiments with some of the Metals.

1. *Volatilization of pure gold.* As this experiment was attended with the developement of a peculiar colour during the dissipation of *gold*, which has not been before noticed, it will be proper to give a more explicit statement than in the preceding instances. That the metal might be exposed in its purest state to the action of the ignited *gas*, I made use of it as precipitated from the solution of *tellurium* in nitric acid. A small quantity thus obtained was fused with borax upon the tube of a tobacco pipe, and reduced into a bead commodiously mounted for being brought into contact with the flame of the ignited *gas*. In the first action of the heat the light was so intense that the gold bead not being discernible in the midst of it, the operation was checked, when it appeared that the *pipe clay* had been fused, the *borax* having the appearance of a glass of *gold*, and the tube of the tobacco pipe being also invested with a shining surface of the metal, resembling *gold* that has been highly burnished. Around the whole, there appeared, upon the pipe clay, a *halo* of the most lively rose-colour, extremely beautiful, and, as to colour, not unlike the appearance exhibited by the *oxide* of *rhodium* when rubbed upon white paper. By renewing the application of the heat, the bead of *gold*, which had been considerably diminished in size, was nearly all volatilized.
2. *Burning of brass wire.* The combustion of *brass* wire owing to the *zinc* was very rapid; and it was accompanied by a flame of a *chrysolite* green colour, differing from that afforded by pure copper. The wire being held in a pair of *iron* forceps, the *iron*, towards the

end of the experiment began to burn with the *brass;* the unburnt part of it being also covered with a deposition from the *zinc,* in the form of a flocculent white oxide.*

3. *Copper wire.* Became rapidly fused, but did not burn.

4. *Iron wire.* Very stout *iron* wire was rapidly consumed: the metal during combustion exhibiting a vivid and highly brilliant scintillation.

5. *Plumbago.* This substance was fused into a *magnetic bead;* the fusion being attended with partial combustion of the *iron.*

6. *Red oxide of Titanium.* Fused, with partial combustion, into a dark-coloured bead.

7. *Red Ferriferous copper.* Rapid fusion, with combustion into a black slag; by continuing the heat the metal was finally developed in its pure state.

8. *Blende,* or common crystallized *sulphuret of zinc.* This substance was fused and reduced to the metallic state; the metal appearing in the centre of the mass; but the parts most exposed to heat were volatilized and deposited in the form of a white oxide, which covered the charcoal used as a support. During this experiment the flame appeared of a *blue* colour.

9. *Brown and yellow oxides of platinum, precipitated from the solution of the metal in nitro-muriatic-acid, by the muriate of tin.* These oxides being placed in a crucible of *pipe-clay,* and mixed with a little *borax,* were speedily reduced to the metallic state, and appeared in the form

* The combustion of *brass* being thus attended by a deposition of the *flowers* of *zinc* upon the *iron* used as a support, a very easy test is afforded of distinguishing ancient *bronze* from modern *brass.* I made an experiment with some *bronze* discovered in a tomb near to the *London* road, between *Sawston* and *Cambridge;* which fused like pure *copper,* without combustion, and without any deposition of *zinc;* and found afterwards that it was a compound of *copper* and *tin,* or *bronze.* Owing to this circumstance, Mr. *Newman's* blow-pipe may perhaps become as necessary to the cabinet of the *antiquary,* as to the laboratory of the *chemist.*

of minute globules shining in the *borax* glass with great lustre.

10. *Grey oxide of Manganese.* This mineral contains so much water, that it was necessary to expose it for some time to a powerful heat in a crucible, to avoid decrepitation, in the particles to be exposed to the ignited gas. It was afterwards fused with great ease into a metallic slag, which admitted the action of the file, and exhibited a shining metallic surface, having the lustre of icon, but somewhat darker.

11. *Metalloïdal oxide* of *Manganese,* crystallized in right prisms with rhomboïdal bases. As this variety, according to *Vauquelin,* is the purest of all the ores of *manganese,* being destitute of *iron,* it was natural to expect that its reduction would exhibit the metal in a state of purity. It was instantly reduced to a brilliant *metal* rather whiter than *iron;* it also burns like *iron;* sending out sparks during its combustion.

12. *Wolfram,* or dark *oxide* of *tungsten.* This substance was readily fused, and as speedily reduced to the *metallic* state. It was first melted into a *black slag,* which by continuance of the heat was kept boiling upon *charcoal* for three minutes. It then exhibited a *metallic* bead, which upon examination resembled in appearance the *magnetic iron* of *Lapland;* not being however *magnetic.* It admitted the action of a sharp fine file, disclosing a *metallic* surface with a very high degree of lustre.

13. *Sulphuret* of *molybdenum.* Became instantly fused, sending forth dense white fumes, and covering a pair of *iron* forceps, whereby it was supported, with a snow-white oxide; among which, with a lens, minute globules of a silver white metal were discernible. The melted mass itself was reduced to a *metal,* upon which the file acted, and disclosed a *metallic* surface resembling that of *arsenical iron.*

14. *Siliceo-calcareous Titanium.* Some crystals of this substance were given to me by *H. Warburton,* Esq.; they had

been brought by the late Professor *Tennant* from the *Sevres* porcelain manufactory. Having selected a very perfect and translucid crystal, and exposed it to the flame of the ignited *gas*, it was instantly reduced to the *metallic* state, being so far *ductile* that when acted upon by the file and examined with a lens, it was evident that the teeth of the file had dragged it. This *metal* is of a brilliant white colour, and like all those obtained from the *brittle metals*, yet retains its metallic lustre, not becoming oxided by the action of atmospheric air. The surface also crystallizes in cooling; as do those of almost all the *metals* of this order.

15. *Black Oxide of Cobalt.* Fused and reduced to the *metallic* state, it has a white silvery appearance, and is partly *ductile.* This substance being held by a pair of *iron* forceps, they became invested during its fusion with a shining slag like black varnish. The metal does not become oxided by exposure to atmospheric air.

16. *Pechblende,* or *dark Oxide of Uranium.* Reduced to a metal resembling steel; but so exceedingly hard that the sharpest file will scarcely touch it. During fusion it deposits on *iron* forceps, a *yellow* oxide of the colour of the Canary bird.

17. *Siliciferous Oxide of Cerium.* Speedily reduced to the *metallic* state. A bead of the metal obtained by fusion exhibited *crystallization* upon its surface in cooling. It became covered with shining dendritic acicular crystals, like those of the *sulphuret of antimony.* Being afterwards filed, it exhibited a bright *metallic* surface, resembling that of *arsenical iron* in lustre and colour. This *metal* also preserves its *metallic* form unaltered, by the action of the atmosphere.

18. *Chromate of Iron.* Fusible with ease into a dark globule, without any *metallic* lustre, but highly magnetic.

19. *Ore of Iridium.* I had proceeded thus far in my experiments, when I received a letter from Dr. Wollaston, recommending that a trial should be made of this substance. Professor Cumming accordingly supplied me

with some very pure grains of the *Ore of Iridium*, which *Dr. Wollaston* had sent to him. These grains were placed upon *charcoal*, and brought into contact with the ignited *gas*. At their first exposure to heat, they became agglutinated and partially fused, shining in the parts where fusion had taken place with a bright *platinum* lustre. After placing the agglutinated mass of *Iridium* upon *Plumbago*, and continuing the heat, the fusion was perfected. The *metal* then boiled, and began to burn with scintillation; depositing a reddish coloured oxide upon the *Plumbago*. Nothing then remained but *glass;* in which state it was sent to *Dr. Wollaston*.

In thus describing the action of the ignited *gas* upon those substances which were hitherto considered as being *infusible*, it will be proper to add, that there are many other minerals improperly classed as *infusible* by some chemists and mineralogists, which are *fusible* by means of the common blow-pipe; and therefore they have not been included in the list. Of this number, are *Jade, Mica, Amianthus, Asbestus, &c.* all of which melt like wax before this powerful apparatus. Again, there are other substances often described as being *fusible*, which are not so by means of a *common blow-pipe;* of this number is the diaphanous *Marekanite of Kamtchatka*, considered as a variety of *Obsidian;* and which appears in *pseudo-crystals* of the *garnet* form, or rhomboïdal dodecahedrons. I never was able to effect even the slightest appearance of *fusion* upon the minutest particles of this mineral, although I have exposed it during a quarter of an hour to the utmost heat of the flame of a *wax* candle, urged by the common *blow-pipe*. When brought before the flame of the *ignited gas*, the fusion was slow and tranquil. The *Marekanite* then exhibited a small globule of limpid colourless glass, like that of rock-crystal after fusion; but having a high degree of lustre and transparency, and being free from bubbles.

To enter upon a detail of the changes produced in bodies that were before known to be *fusible*, would extend this article to too great a length for insertion in your Journal. I shall

therefore confine the rest of my observations to those results which I obtained by a renewal of my experiments upon the *earths*; whereby I was enabled to establish, beyond a doubt, the *metallic* nature of *Barytes* and *Strontian*, and to exhibit the *metals* obtained from those *earths*, in the presence of the Gentlemen before mentioned, and of other members of the University. I also obtained, in one instance, a *metal* from pure *Silex*, which still retains a greater degree of *metallic lustre* and *whiteness* than the purest *silver*; but this last *metal* I have not been able yet to reproduce in a manner altogether satisfactory. To begin therefore with *Barytes*.

Having obtained a portion of this *earth* in a state of purity, I mixed some of it (*August* 20,) with *lamp-oil*, and rubbed both together in a *porcelain* mortar, into a paste.* This *paste* being placed upon *charcoal*, was brought to the *ignited gas*, and kept exposed to its most intense heat, for some minutes.† By this means it was fused, and assumed the form of a black shining *slag*, like that of *iron* from a foundry. A small portion of this *slag* was then held, by means of a little *borax*, upon the end of the tube of a tobacco-pipe; and again exposed to the *ignited gas*. The *slag* being now firmly fixed upon the pipe-clay admitted the action of the file, and exhibited a shining *metallic* surface, resembling that of silver. This experiment was repeated many times, sometimes with *charcoal*, and sometimes without, and always with the same result. In every instance, the *slag*, when filed, exhibited *metallic* lustre; which when the *metal* was pure appeared brighter than *silver*; if imperfectly obtained, it resembled *lead*; and sometimes it had hardly any *metallic* lustre and resembled *horn*. I then determined to watch the effect that might be produced by keeping the *slag* upon *charcoal* during a long continuance of the heat. For this purpose, I

* This process however is not necessary. I have subsequently found that the earth of *barytes* is instantly reducible to the *metallic* state, without any addition either of *oil* or of *charcoal*.

† The heat may be always graduated by increasing or diminishing the volume of gas from the aperture as the screw of the stop-cock is turned.

consumed three measures of the condensed *gas*, from the reservoir of the *blow-pipe*. The *slag* was reduced to a *yellowish* glass; and the flame was tinged, during the utmost intensity of the heat, with a *chrysolite-green* colour. Believing from the appearance of this *glass* that I had continued the heat too long,* and that the *metal* was consumed, I tried what effect would be produced upon it by moisture, by placing it in a wine-glass half-filled with pump water. It began slowly to decompose the water; there falling off into the liquid, from the surface of the glass, a whitish powder. I then added some *nitric* acid; but the solution being very slow, and almost imperceptible, I took out the small lump of glass, and having examined it with a lens, perceived that a dark substance, resembling *lead*, existed towards the centre of the mass. Bringing it therefore again to the action of the *ignited gas*, it became fused once more into a black shining *slag*, in all parts that were brought into contact with the flame; and this *slag* after being filed, *disclosed* a brighter surface of *metal* than any that I had yet seen. I can only compare it as to colour and lustre to the purest *silver*, and it seemed to be equally ductile. In the space of three minutes, however, it became oxided, but the *metallic* lustre was again renewed by the application of the file, until at last the whole of the *metal* was filed off, and a dull slag which was not metallic remained, with a degree of lustre resembling the appearance of horn. The nitrous solution whence it had been taken, exhibited, to the *Prussiate of Potass*, a copious precipitate of a deep *green* colour; but this precipitate may be due to impurities both in the *water* and in the *acid*. The existence however of the *metal* of *Barytes* no longer admits of the smallest doubt. As it will be necessary to bestow some name upon it, and as any derivative from Βαρυς would involve an error, if applied to a *metal* whose *specific gravity* is inferior to that of *Manganese* or *Molybdenum*, I have ventured to propose for it the appellation of PLUTONIUM; because we owe it

* Many subsequent experiments have convinced me that *charcoal* has the property of *vitrifying* the *metals* of the *earths* during their reduction; and that it is better not to make use of it in these experiments.

entirely to the *dominion of fire.* According to *Cicero* there was a *temple* of this name, dedicated to the *God of Fire,* in *Lydia.*

Afterwards I pursued nearly the same course with *Strontian,* and obtained from it repeatedly a *metal,* like that of *Barytes;* the *Strontian* burning, as usual, with its beautiful purple flame. This metal retained its lustre for many hours, but at last it became *oxided,* and appeared in the *earthy* state again. I have called it *Strontium,* as recommended by *Sir H. Davy,* in the account of his experiments for the decomposition of the *earths.** Afterwards pursuing the same process with regard to *Silex,* I obtained in one instance a brilliant bead, of pure white *metal,* which I have called *Silicium,* for the same reason; but this metal I am at present unable to re-produce. Indeed a temporary suspension of my experiments has taken place, in consequence of a circumstance which I shall now mention.

A great deal has been said of the danger attending these experiments: it may concern your readers therefore to know, that during one entire month, in which I have been employed uninterruptedly in experiments with the *blow-pipe,* I have met with no accident. My tube of glass, as represented in the wood cut by A, was at first three inches in length, and the bore of it was at least $\frac{1}{70}$ of an inch in diameter. During these experiments, the end of the tube was constantly breaking, owing to sudden changes of temperature, until at last I worked daily with a tube only $1\frac{3}{8}$ inch in length. It has been said, indeed, that "*the danger lies in the chance of a retrograde movement of the flame, which may be drawn backwards towards the reservoir, and thus cause it to explode.*" I have seen this *retrograde* movement of the flame, very often; it happens when the current of *gas* is feeble; either when the reservoir is nearly exhausted, or when the current is suppressed in the beginning of an experiment. But then the flame is instantly extinguished by turning the valve; and if it be not thus extinguished, it will be drawn backward only about half an inch, when, after splitting the end of the glass tube, it goes out of

* See "*Electrochemical Researches on the Decomposition of the Earths, &c.* Read before the Royal Society, June 30, 1808, p. 14.

itself. Being resolved, however, to observe what the effect of actual explosion would be, we condensed about four pints of the explosive mixture into the reservoir, which was all that it was capable of containing, and having tied a long string to the handle of the valve, we took out the glass tube A, leaving the gas to rush against the flame of a spirit lamp, through an aperture nearly $\frac{1}{8}$ of an inch in diameter. Professor *Cumming* held the string, and opened the valve, standing within about six yards of the apparatus; the rest of us were dispersed towards the extremity of a large room in which the *Chemical* Lectures are delivered. Upon opening the valve, the whole of the gas exploded, with a noise nearly equal to the report of a cannon; and with such violence, as to tear open the copper reservoir C, one part of which being driven against a wall, was bent double. The stop-cock was also blown out. That danger, therefore, may arise from too large an aperture, is evident; but with the proper precautions, an explosion is rendered impossible. I shall continue my experiments with a similar apparatus, and with a much larger reservoir, as soon as it can be prepared.

To conclude, I consider this improvement of the *blow-pipe* as one of the most valuable discoveries for the sciences of *Mineralogy* and *Chemistry*, which has yet been made, and I have no doubt but that the use of such an apparatus will become universal. Its portable form, the great ease of conducting the experiments, and the advantages afforded in being able to stop the operation at pleasure, so as to observe all the changes that ensue, and thereby to watch the progress of every analysis that may take place, give it a decided superiority over every contrivance that has hitherto been adopted; and when to all these is also added the wonderful fact, that, by means of an apparatus so diminutive, a degree of heat is produced surpassing that of the most powerful *Galvanic battery*, it will surely be allowed that the inventor of this blow-pipe is entitled in no common degree to the thanks and praises of his contemporaries.

I have the honour to be, &c. &c.

EDWARD DANIEL CLARKE.

Cambridge, Sept. 1, 1816.

P. S. *Sept.* 14.—Since the foregoing letter was written, I have renewed my experiments. I no longer find it necessary to use *oil* or *charcoal*, in obtaining the *metals* of the *earths*. The *metal* of *Barytes* is obtained directly and almost instantaneously from the *earth* itself. I have estimated the specific gravity of the *metal* of *Barytes*, and find it to equal 4.000. But as bubbles of *hydrogene* adhere to the *metal* during the experiment, owing to the decomposition of the water, and as it becomes rapidly oxided and falls to powder, this estimate may be too low. Yesterday I placed some pure *silver* in contact with the *metal* of *Barytes*, and fused the two metals together; the result is an *alloy* of a darker hue than *silver*, somewhat resembling granular *tin* or *lead*. By continuance of the heat, the *silver* is dissipated in dense white fumes. If the name which I have proposed for the *metal* of *Barytes* be adopted, this *alloy* may be called *Plutonial Silver*. I afterwards tried a similar experiment with *gold*, but the two metals did not combine. No change was effected in *Plutonium*, simply by bringing it into contact with *mercury*. Its action upon *Palladium* is of a very peculiar nature; when placed upon a polished *lamina* of this metal, and heated by the ignited gas, it spreads over the surface, in appearance resembling a *bronze* varnish, and thus forms an alloy with it, until the *Palladium* begins to fuse. When fused upon *Platinum*, it gives to this metal a superficies resembling polished *brass*. One of the most remarkable results which I have obtained by means of this blow-pipe, is that of IRON, from METEORIC STONES; all of which are reducible without any diminution or increase of weight, to *iron*; admitting the action of the file, and disclosing a bright *metallic* surface, and being highly *magnetic*. This *iron* resembles that which whitesmiths call *iron blubbers* in *clinker*; and it has the same specific gravity; not exceeding 2.666; the metal being nearly in the state of *slag*. Hence it follows, that for the fall of *iron* from the atmosphere, nothing more is requisite than that the *stony concretions* which form in the atmosphere should undergo a greater degree of heat, than that which has attended their deposition when they descend in the form of *stones*. I exposed this day, *eight* grains of one of the *meteoric stones* that fell at *L'Aigle* in *Normandy*, to the action of the ignited gas; it became speedily fused, and exhibited a black *slag*; by continuance of the heat, this *slag* began to boil, and was reduced to a bead of *iron*, weighing exactly *eight* grains. The further consequences of this remarkable fact, I must for the present leave to the reflections of your readers. If the heat be too long continued, a combustion of the *iron* ensues, attended with the usual phenomena.

Art. XIII. *Notice of some Experiments and new Views respecting Flame.* By Sir H. Davy.

When a wire-gauze safe-lamp is made to burn in a very explosive mixture of coal gas and air, the light is feeble, and of a pale colour; whereas the flame of a current of coal gas burnt in the atmosphere, as is well known by the phenomena of the gas lights, is extremely brilliant. In a Paper read before the Royal Society, I have endeavoured to shew, that in all cases flame is a continued combustion of explosive mixtures; it became, therefore, a problem of some interest, "Why the combustion of explosive mixtures, under different circumstances, should produce such different appearances?" A very acute philosopher, who himself started the subject in conversation, suggested the idea, that in the combustion of explosive mixtures within the lamp, carbonic oxide might be formed; and that the light might be deficient, from the deficiency of the quantity of oxygene necessary to produce carbonic acid. On submitting this idea to the test of experiment, it was discovered to be unfounded; for, by the combustion in the wire-gauze lamp, carbonic acid was produced in quantities as great as could have been expected from the quantity of oxygene consumed; and on adding oxygene to a mixture in quantities more than sufficient to burn the whole of the gas, the character of the light still continued the same.

In reflecting on the circumstance of the two species of combustion, I was led to imagine that the cause of the superiority of the light of the *stream* of coal gas might be owing to the *decomposition* of a part of the gas towards the interior of the flame where the air was in smallest quantity, and the deposition of solid charcoal, which, first by its *ignition*, and afterwards by its *combustion*, increased in a high degree the intensity of the light: and a few experiments soon convinced me that this was the true solution of the problem.

I held a piece of wire-gauze, of about 900 apertures to the square inch, over a stream of coal gas issuing from a small pipe, and inflamed the gas above the wire-gauze, which was almost in contact with the orifice of the pipe; when it burned

with its usual bright light. On raising the wire-gauze so as to cause the gas to be mixed with more air before it inflamed, the light became feebler; and at a certain distance the flame assumed the precise character of that of an explosive mixture burning within the lamp; but though the light was so feeble in this last case, the heat was greater than when the light was much more vivid, and a piece of wire of platinum held in this feeble blue flame became instantly white hot.

On reversing the experiments by inflaming a stream of coal gas, and passing a piece of wire-gauze gradually from the summit of the flame to the orifice of the pipe, the result was still more instructive; for it was found that the apex of the flame intercepted by the wire-gauze afforded no solid charcoal; but in passing it downwards, solid charcoal was given off in considerable quantities, and prevented from burning by the cooling agency of the wire-gauze; and at the bottom of the flame, where the gas burnt blue in its immediate contact with the atmosphere, charcoal ceased to be deposited in visible quantities.

This principle of the increase of the brilliancy and density of flame by the production and ignition of solid matter, appears to admit of many applications. I have commenced the experimental investigation of some of them; but as my enquiries are still unfinished, I shall hint only at the most obvious of the views connected with them. On a future occasion I hope to be able to pursue at full length this interesting subject.

1st. The principle explains readily the appearances of the different parts of the flames of burning bodies, and of flame urged by the blow-pipe; the point of the inner blue flame, where heat is greatest, is the point where the whole of the charcoal is burnt in its gaseous combinations without previous deposition.

2dly. It explains the intensity of the light of those *flames* in which *fixed* solid matter is produced in combustion, such as that of the flame of phosphorus and of zinc in oxygene, &c. and of potassium in chlorine; and the feebleness of the light of those flames in which gaseous and volatile matter alone is produced, such as those of hydrogene and sulphur in oxygene, phosphorus in chlorine, &c.

3dly. It offers means of increasing the light of certain

burning substances, by placing in their flames even incombustible substances. Thus the intensity of the light of burning sulphur, hydrogene, carbonic oxide, &c. is wonderfully increased by throwing into them oxide of zinc, or by placing in them very fine amianthus or metallic gauze.

4thly. It leads to deductions respecting the chemical nature of bodies and various phenomena of their decomposition. Thus ether burns with a flame which seems to indicate the presence of olefiant gas in that substance. Alcohol burns with a flame similar to that of a mixture of carbonic oxide and hydrogene; so that the first is probably a binary compound of olefiant gas and water, and the second of carbonic oxide and hydrogene.

When cuprane or protochlorid of copper is introduced into the flame of a candle or lamp, it affords a peculiar dense and brilliant red light, tinged with green and blue towards the edges, which seems to depend upon the chlorine being separated from the copper by the hydrogene, and the ignition and combustion of the solid copper and charcoal.

Similar explanations may be given of the phenomena presented by the action of other combinations of chlorine on flame; and it is probable, that in many of those cases when the colour of flame is changed by the introduction of incombustible compounds, that the effect depends upon the production and subsequent ignition or combustion of inflammable matter from them. Thus the rose-coloured light given to flame by the compounds of strontium and calcium, and the yellow colour given by those of barium, and the green by those of boron, may depend upon a temporary production of these bases by the inflammable matter of the flame.

Whenever a flame is remarkably brilliant and dense, it may be always concluded that some solid matter is produced in it: on the contrary, when a flame is extremely feeble and transparent, it may be inferred that no solid matter is formed. Thus none of the volatile combinations of sulphur burn with a flame in the slightest degree opaque; and, consequently, there is no reason, from the phenomena of its flame, to suspect the existence of any fixed basis in sulphur.

5thly. These views will probably offer illustrations of

electrical light. The voltaic arc of flame from the great battery, differs in colour and intensity according to the substances employed in the circuit; and is infinitely more brilliant and dense with charcoal than with any other substance. May not this depend upon particles of the substances separated by the electrical attractions? and the particles of charcoal being the lightest amongst solid bodies (as their elementary proportional number shews), and the least coherent, would be separated in the largest quantities.

6thly. The heat of flames may be actually diminished by increasing their light (at least the heat communicable to other matter), and vice versa. The flame from combustion which produces the most intense heat amongst those I have examined, is that of a mixture of oxygene and hydrogene in slight excess, compressed in Newman's blow-pipe apparatus, and inflamed from a tube having a very small aperture.* This flame is hardly visible in bright day light, yet it instantly fuses very refractory bodies; and the light from solid matters ignited in it, is so vivid as to be painful to the eye.

London, July 21, 1816.

Art. XIV. *On the Effects produced in Astronomical and Trigonometrical Observations, &c. by the Descent of the Fuid which lubricates the Cornea. By* David Brewster, *LL.D. F. R. S. Lond. and Edin. and F. A. S. Edin.*

The operations of trigonometry and practical astronomy have been brought to such a high degree of perfection by the use of correct instruments and improved methods of observation, that we can scarcely expect to introduce into them an additional accuracy, but by the discovery and correction of minute sources of error, which, though sometimes unappre-

* John George Children, Esq. first proposed to me this application of Newman's apparatus, immediately after I had discovered that the explosion from oxygene and hydrogene would not communicate through very small apertures, and I first tried the experiment with a fine glass capillary tube. The flame was *not visible* at the end of this tube, being overpowered by the brilliant star of the glass ignited at the aperture.

ciable in their individual effects, may yet amount to a perceptible quantity when accumulated. These sources of error arise from variations in the condition of the atmosphere, and of the instruments employed: from imperfect graduation; from a defect of distinctness and achromatism in the telescope; and from certain imperfections, either of a transient or a permanent nature, in the eye of the observer. The object of the following Paper is to point out a source of error of considerable amount, arising from the last of these causes.

In the year 1798, when I was engaged in performing a series of experiments on the inflexion of light, I observed that the fringes which bordered the shadow of a bent wire, were always most distinct in the vertical branch of the wire, and that the distinctness gradually diminished as it approached to the horizontal position. The same effect may be more readily observed by placing a delicate wire, or fibre of any kind, a little out of the focus of the eye-glass of a telescope, or a compound miscroscope. By directing the instrument to a candle, or any other luminous object, fringes will be seen both without and within the shadow; but those within the shadow will not be visible unless when the wire is in or near the vertical position. In every case, indeed, where the object consists of one or more lines or stripes, it will always be found that they appear most distinct when they are placed perpendicular to the horizon. We may therefore consider it as a physiological fact perfectly established, that in the human eye a greater distinctness of vision may be obtained by placing the object in a particular direction.

In order to ascertain the cause of this remarkable fact, I reflected the image of a candle from a convex speculum, and having adjusted my eye to a distance considerably less than that which gave distinct vision, I perceived that the circular image into which the candle was expanded, instead of having an uniform density, was covered with small specks of light. Upon shutting my eye slowly, these luminous spots were put in motion towards the horizontal diameter of the circular image, and again retired upon the separation of the eye-lids. The repetition of these experiments under different circum-

stances proved that the specks of light arose from the imperfect fluidity of the secretion which lubricates the cornea;* that this fluid never has a perfectly smooth and spherical surface; that its surface is never at rest, but is constantly disturbed by the closing of the eye-lids; and that it is either in a state of descent from its own gravity, or is drawn by capillary attraction to the horizontal reservoirs of fluid which are lodged at the junction of the tarsi with the cornea.

These results enable us to explain, in a satisfactory manner, why lines placed horizontally are less distinct than those which are placed vertically. The vertical descent of the lubricating fluid crosses and renders indistinct the horizontal lines, while the direction in which it descends coincides with that of the vertical lines, and therefore scarcely affects their distinctness. This conclusion may be illustrated experimentally, by observing horizontal and vertical stripes through a plate of glass, over whose surface a thin stratum of oil is made to descend slowly.

Having thus ascertained the cause of the phenomenon, we shall now consider how far it is possible to correct the error which the descent of the fluid occasions in astronomical and trigonometrical observations. It is obvious, in general, that the wire, and the object which is brought to coincide with it, should always be in a vertical line, and that when the observation consists in making the object bisect the angle formed by two wires, the inclination of the wires should be made as small as possible.

When the diameter of the sun, moon, or any of the planets is measured by a heliometer, or a double image telescope, the two images should be brought into contact when they are in a horizontal line, in order that the two lines, the contact of which is observed, may have a vertical position. Astronomers

* The state of this fluid seems to vary with the health of the individual. It is much more viscid in adults than in infants. I have often observed it so thin in children between two and four years of age, as to produce the colours of thin plates of the second and third order. Hence its thickness must have been between the *fifty thousandth* and the *hundred thousandth* part of an inch.

would naturally have adopted this method at low altitudes where every other diameter but the horizontal one is affected by refraction; but they will now see the propriety of measuring the horizontal diameters of the planets even at altitudes, where they do not sensibly differ from the vertical ones.

In measuring the diameter of the sun and moon, &c. by the common wire micrometer, we are compelled to take the vertical diameter, on account of the rapidity with which the planets move across the field of the telescope; and, therefore, the indistinctness arising from the descent of the lubricating fluid is in this case a *maximum*, unless when the diurnal path of the planet is considerably inclined to the horizon. In order to remedy this evil, it will be necessary to use either a prismatic eye-piece, or a plain metallic speculum to receive the pencil which emerges from the eye-glass, so as to throw the horizontal wires into a vertical position. By this means the same advantage will be gained as if the horizontal diameter had been measured by vertical wires.

In observing the belts of Jupiter, and the black line which forms the division between the two rings of Saturn, as well as other celestial phenomena, a prismatic eye-piece, or plain speculum will be found of essential use, in order to bring the longitudinal direction of the object into a vertical line.

It would be unnecessary to point out the various cases in which the preceding principles may find a practical application. In the arts of engraving and ornamental painting, and in the decoration of apartments, they may often be applied with considerable success.

Although it is rather unconnected with the subject of this paper, I cannot neglect the opportunity of drawing the attention of the reader to another source of error, in all observations where the achromatic telescope is employed, of which neither the theoretical nor the practical optician has hitherto been aware. "It arises," as I have remarked in another place,* "from a crystallisation in the glass, which is always accompanied with double refraction, and with a variation of

* *Edinburgh Transactions*, Vol. VIII. Part I. now in the press.

" density. This crystallisation, which most frequently affects " the flint glass, and which can easily be detected by its action " upon polarised light, should be carefully removed from every " piece of glass used in the construction of optical instruments, " by annealing it in an oven of high temperature, where the heat " is regularly and very slowly reduced." When this passage was written, I had observed the crystallised structure only in masses of flint glass, and never in finished object glasses. Upon mentioning this circumstance to my friend Captain Colby, he informed me, that in the telescope of the great Theodolite used in the Trigonometrical Survey, vision was always most distinct at some distance from the centre of the field. It immediately occurred to me, that this might arise from the crystallisation of the glass; and upon exposing it to polarised light, this conjecture was completely verified.* The object glass polarised a bluish white of the first order, and the axes of crystallisation were all directed to a point on one side of the centre, the intensity of the polarised light being greater in one of the four quadrants than in the rest. Captain Colby marked this point upon the object glass; but he has not yet had an opportunity of observing if it coincides with the place where vision is most distinct.

* Sometimes an irregular crystallisation is produced, both in object glasses and eye-glasses, by a pinching of their edges, when they do not lie easily in their cells. I have often observed this effect produced in a great degree, and it is no doubt the cause why the lenses of telescopes are frequently broken by very trifling accidents.

Art. XV. *Further Account of Mr.* Samuel Clegg's *Improvements of the Apparatus used in Gas Illumination.*

A description was given in the last Number of this Journal of some Gas Apparatus invented by Mr. Clegg, and used with great advantage at the works in Peter-street, Westminster. In the present Number we are enabled to describe some other inventions of that gentleman, calculated to diminish the expense of the works and increase the accuracy of their application.

The apparatus called a *governor*, is intended to preserve the pressure constant in the tubes or vessels connected with it, however it may change in the gasometer. It is therefore placed between the gasometer and the parts to be regulated; *i. e.* the mains, supplying pipes, and burners: and it performs its office so perfectly that any alteration in the quantity of gas passing through it, does not affect the pressure; so that the flame of a burner supplied from it remains uniform, though the pressure in the large gasometer may vary, or though other burners connected with it may be shut on and off very irregularly.

This instrument is delineated in Plate II. where A is the pipe of supply which brings the gas, and B the pipe which conveys the gas away to the burners; the pipe A turns down, and communicates with a short piece of a large pipe C, in which is a partition E; the lower end of the pipe C is open, and is immersed beneath the surface of mercury or other fluid contained in the cup F. An opening or passage is made in the partition E, for the gas to flow through from the pipe A into the pipe B; but as the lower part of this opening is formed by the surface of the fluid in the cup, it is plain that by raising or lowering the cup the fluid will rise or fall, and diminish or increase the size of the passage E. A branch R turns up from the pipe B, beneath a small gasometer G, contained in the water cistern H. The gasometer is guided

in its motion by a perpendicular stem or wire in the centre, which is received in a tube passing through the centre of the gasometer and soldered to it. K L M is a lever moveable on the centre L. At the end K of the lever is an arch for a small chain which is attached to the gasometer; at N is a smaller arch nearer to the centre, for suspending the cup F; at the opposite end of the beam a weight is applied to counterbalance the weight of the cup.

The use of the governor is to regulate the pressure with which the gas shall be urged to issue at B. This pressure is determined by means of a certain weight applied upon the gasometer G, so as to occasion a sufficient difference between the level of the water within and without it; and the action of the governor makes this pressure uniform; for if the force of the gas at A is increased, so as to send a greater quantity through the opening E, the pressure within the gasometer will be also increased, and cause it to rise up; this will elevate the cup and contract the opening of the passage so as to diminish the quantity of gas which shall pass through until the pressure within the gasometer is restored to its original degree. In the same manner, if the pressure at A is diminished, the quantity of gas which will pass through the opening will also be diminished, so as to allow the gasometer to descend lower into the water; and that, by lowering the cup allows a greater quantity of gas to pass, and restores the intended pressure in the gasometer. The governor will effect the regulation in an equal degree whether the inequalities of pressure are occasioned by an increased consumption at B, or by an increased pressure at A; for the operation of it is to adapt the opening E to the quantity of gas which is required to pass, so as to preserve an uniform pressure in the small gasometer and consequently in all the tubes and other apparatus connected with it.

The following is a description of Mr. Clegg's new horizontal flat retort, represented in Plates IV. and V. It is about twelve feet in diameter, and is made of plates of iron, or other proper metal rivetted together in the form represented in the section Fig. 2: it is supported in brick-work, as at Fig. 5, so as

to be over the fire-place C by which it is heated. The opening through which the materials are to be introduced and withdrawn, is at E, *Fig.* 2; B is a perpendicular shaft or axis placed in the centre of the retort; to the lower end of this several iron arms, *a a*, are affixed, radiating from the centre, as shewn in Fig. 3, and extending nearly to the circumference of the retort.

The coals to be distilled are put into a number of shallow boxes or trays H, one of which is suspended upon each of the arms *a a* by a groove formed in the under side of the box, Fig. 3, deep enough to receive the arm upon which it is suspended.

Each box is formed to the segment of a circle, so that the whole number being suspended on the arms, as represented Fig. 1, forms a circular tray or dish which covers the bottom of the retort, and is capable of being turned round within it by the lever *d*, upon the upper end of the axis B.

By this motion of the boxes round the axis, any one can be brought opposite to the door E to be withdrawn from the arm to which it belongs. Each box is provided at the end with a latch, which falling into a notch in the end of the arm holds the box firm when in its place, as in Fig. 1; but this latch being lifted up, the box can be drawn off from the arm through the door.

C, No. 5, is the fire-place; 1, 2, and 3, the flues which conduct the flame beneath the retort, as shewn in Fig. 4. These flues are carried under about one-third of the area of the bottom of the retort, and after rising up at 4, are continued over the same part of the retort at 5, and then pass into the chimney.

By this means, about one-third part of the whole retort is heated to the temperature required for producing the gas, and if there are 15 boxes placed upon the arms of the axis B, only five of the number will be exposed at once to the full action of this heat. The mouth of the retort at which the boxes are separately introduced or exchanged, is on the opposite side to that heated by the fire, and is provided with a door or lid, 6, Fig. 5, which is ground to fit tight against the edge of the

opening, and has a bar or frame, 15, fastened to it, and jointed at the upper and lower ends to two rods, 7 8, which move on centres at 9 9. These have spiral or other springs as at 10, to draw the door close. The motion of the rods on the centre *as shewn by the dotted lines, allows the door to be slided down* below the opening into the retort, at which time boxes may be introduced or withdrawn.

The weight of the door, and of the upright frame 15, must be counterbalanced by a weight or spring applied at the upper end of the rod 11. The axis B, by which the boxes are turned round, passes through an opening at the top of a central tube which rises from the retort. This opening is made air-tight by means of a circular inverted cup, which is fixed to the axis; the lower edge of the cup passes into oil, metal, or any other fluid substance, capable of withstanding the heat, contained in a corresponding cup formed on the edge of the opening. The upper part of the axis B is suspended in a collar, and by two rods, 12, and by a screw, 13, or by other means, the axis and all the boxes suspended from its arms may be raised up from the bottom of the retort or lowered down to rest flat upon it. The lower end of the axis is perforated with a hole to receive a cylindrical pin, which rises perpendicularly from the bottom of the retort, by which means the axis in being raised always preserves its centre. A lever as *d* or any kind of mechanism is fixed upon the upper end of the axis to turn it round by, and cause all the boxes to revolve in the retort, they being previously raised up from the bottom by means of the screw or other power.

To ascertain that position of the axis which will bring each box exactly opposite to the door of the retort, pins or teeth are fixed into the edge of a wheel, on the upper end of the axis B, to correspond with the several arms upon which the boxes are suspended, these pins being brought opposite to any fixed pin or mark, will determine the proper positions. For the facility of sliding the boxes in and out, an iron table is placed level with the bottom of the retort; upon this table an iron bar is fixed up edgeways, to correspond with the

arms, and the box being placed upon this bar and slid forwards will be conducted into its place upon the arm. The table is made of sufficient length to hold several boxes ready filled and in a state to be introduced into the retort.

D is a pipe by which the gas is discharged from the retort, and carried off to its destination. It is situated over the coolest part, by which means part of the tar is condensed in it, and falls down upon the coal contained in the boxes to be subjected with it to the action of the heat, when the axis is turned round.

The operation of this retort will be as follows: the coal must be thinly spread in the boxes in layers from 1 to 3 inches in thickness, and the mouth of the retort being opened by depressing the slider, the boxes are placed one by one on the iron bar which is across the table, from which they are introduced through the door and put into their places upon the arms of the axis. The whole circle being filled in this manner, the axis is lowered down until the boxes rest upon the bottom of the retort, and one-third of the number or the five which are immediately over the fire, are exposed to the heat until sufficiently coked; at the same time, the coal in the other boxes, is gently heating and drying.

Being then suspended by the screw, 13, the whole set of boxes is moved round one-third of the circle. This removes the five from the action of the fire towards the door, and brings other five over the fire to undergo the same operation. When the first mentioned five which contain the coke or coal from which the gas has been obtained, arrive at the door they must be drawn out, and re-placed with others containing fresh coal; therefore so long as this operation is continued, one third of the number of boxes, viz. those last introduced, are drying and warming previous to their undergoing the red heat, another third are over the fire, and the remaining third which have been heated, are cooling ready to be drawn out.

The following statement will shew the advantages which this

retort possesses over the common cylindrical or square retorts; deduced from the practice upon each.

Practice of the old Retorts.

' One chaldron of small coal distilled, produces upon the average 10,000 cubic feet of gas, with the usual proportion of tar and ammoniacal liquor: these latter mentioned products being nearly the same in both cases, it will only be necessary to mention the other products. The coal consumed by this operation is ¼ of a chaldron, requiring 8 hours for the complete decomposition, employing 20 retorts, with 5 fire places attended by two men; the time required for the operation of drawing and charging is one man about 10 minutes for each retort: the cost may therefore be estimated as follows:

	L.	S.	D.
¼ chaldron of small coal, at 42*s*. - - -	0	10	6
2 Men, 8 hours attending the fires, - - -	0	6	0
Wear and tear of grate bars, 8 hours, at 6d. each,	0	2	6
Do. ——— of 20 retorts for do. at 6d. -	0	10	0
Men's time in drawing and charging, - -	0	1	6
Luting, - - - - -	0	0	6
Repairing pokers, shovels, &c. - - -	0	0	8
1 chaldron of small coal, 42*s*. - -	2	2	0
Total cost	3	13	8

	L.	S.	D.
The products. 10,000 cubic feet of gas, at 15s.	7	10	0
1¼ chaldron of coke, at 32*s*. - -	2	0	0
	9	10	0
Cost	3	13	8
Net profit by the old retorts, - - -	5	16	4

Practice of the Horizontal Retort.

One chaldron of small coal by this process will produce 18,000 cubic feet of gas in 3 hours, with 10 per cent. fuel employing 3 retorts, and 3 fires; the cost as follows.

		L.	*S.*	*D.*
1 chaldron of small coal, - -	at 42*s.*	2	2	0
10 per cent. of coal for distilling the same, - -		0	4	2
2 Men attending the fires 3 hours, - -		0	2	0
Wear and tear of grate bars for 3 hours -		0	0	8
Ditto———of 3 Retorts, - - -		0	3	4
Men's time drawing and charging 3 retorts twice,		0	0	4
Repairing pokers, &c. - - - -		0	0	2
	Total cost	2	12	8

	L.	*S.*	*D.*
The products. 18,000 cubic feet of gas, at 15s.	13	10	0
2½ chaldron of coke, at 20*s.* - - - -	2	10	0
	16	0	0
Cost	2	12	8
Net profit by the new retorts - - -	13	7	4
Do.———by the old do. brought over, -	5	16	4

The interest of the capital expended in the apparatus is nearly the same in each case.

The coke produced by the new process is better adapted for domestic fires than the best coal, being much less expensive, easier to light, makes a brighter fire, and is attended with less dirt and trouble.

The great inconvenience in drawing the red hot coke from the the old retorts is obviated by the new ones, which retain it till nearly cool.

Art. XVI. *Description of the River Meta. By* M. Palacio Faxar.

Though the coasts of South America are well known, the interior of the country has been but little explored. Travellers have contented themselves with describing what they found worthy of notice in the high-roads, if the paths can deserve the appellation of high roads, which are entirely formed by the feet of the mules in the necessary communication between the different cities. The principal provinces of the Spanish settlements in South America being situated along the Cordilliera, this part is the best marked in the maps; but the low country on the east, which is more extensive, and through which flow the river La Plata, Amazonas, and Oronocco, is yet imperfectly and erroneously represented. Baron de Humboldt, surmounting every obstacle, has lately ascertained to a great extent the course of the Oronocco. La Condamine had before traced part of that of the Amazonas. But the courses of the greater number of the smaller rivers, which fall into these larger ones, are yet unknown. When the inhabitants of South America become better acquainted with the topography of these rivers, as they are now with the communication between the Amazonas and the Oronocco, ascertained by Baron de Humboldt, their intercourse will be easier and their prosperity certain. This period is not distant, if they are successful in establishing their independance, or if an enterprising and commercial nation should resolve to take these countries under its protection.

Don Jozè Cortes Madariga, who was deputed on an important mission by the Government of Caraccas to that of Santa Fè de Bogota, in the year 1811, being desirous of procuring an easy communication between New Granada and Venezuela, determined to return to Venezuela by the river Meta, which was then little known, and he effected it in the following manner :—he took the road leading to the valley of Apiay at the south of Santa Fè of Bogota, and having travelled

nearly forty maritime leagues of twenty in the degree, he reached the river of Pachaquiaro, which runs through this valley. He there provided himself with the necessary number of boats, to convey two* of his friends, men of distinguished talents, Don N. Camara and Don J. Maria Salazar, and likewise his attendant suite. Having gone down the Pachaquiaro, till it joins the Rio Negro, which runs from north-west to south east, and which they likewise sailed down till its conjunction with the river Umeda, which comes from the west; they reached the river Umadea, three leagues distant from the Umeda; these three rivers, united at this place, take the name of Meta.

Seven leagues below, is situate the mission of Cabullaro, on the banks of the Meta, on the north side; and six leagues further on the same side, the river Upia falls into the Meta. Four leagues hence they discovered the river Tua, and on the opposite side is the mission of St. Michael de Tua, near a lake, five leagues from the mouth of the Tua. Seventeen leagues from this river, the Meta receives from the north the river Vira. The Meta having thus far flowed towards the north-east, now inclines north-north-east. Between the Vira and the river Cusiana, about sixteen leagues from the Vira, and twelve from the Cusiana, live several wandering Indian tribes, the Chucnas, Cabres, Guagivos, and some of the Achaguas; the southern side is inhabited by another tribe of the Achaguas; and likewise by the Amarizanos. Buenavista is situate close to the torrent Areba, which discharges itself into the Meta on the south side, near two leagues down the Cusiana. Here is likewise the mission Arimena, four leagues from the mouth of the Cravo; and opposite to it on the other side is the Surimena, on the torrent of Surimena, which enters the Meta one league down the river Guarimena. The Guarimena falls into the Meta from the north, near the river Cravo. On the south side the Meta receives the river Manacasia, seven leagues up the Cusiana. Four leagues from the mouth of the Vira is the mission of Maquibo, near the torrent of the same name, and that of Casimena is situate on the Cusiana. Seventeen leagues from the Cravo, Don J. Cortes Madariaga dis-

covered one, of the largest islands in the Meta, which he called Berrio, from the name of one of his friends. This island is opposite to the mouth of the Guanapalo, which falls into the Meta on the north side, and on its banks is the mission Guanapalo. On this side of the Meta, live the tribes of the Cataros, Chorotas and Salivas; and on the Southern side, other tribes of the Cataros and Amarizanos. From the island Berrio to the river Casanare, the Meta runs towards the north-east, receiving the rivers Pauto, Guachiria, Ariporo, Aricaporo, and Chire, from the north-west side, at the distance of three, seven, five, and eight leagues from the Cravo. Near two leagues from the Chire, is the mouth of the river Casanare: this river contributes much to the fertility of the province of Los Llanos, the last of the provinces of New Grenada bordering Venezuela, on that side.

The Meta, until it reaches the Casanare, near that range of the Cordilliera mountains, which traverses Venezuela and New Grenada, receives all the waters that fall from the mountains; but from the Casanare till it empties itself into the Oronocco, it is not encreased by any considerable fall of water; for the rivers Arauca and Apure receive all the waters that come from the Cordilliera in their neighbourhood. Soon after the junction of the Meta with the Oronocco, fifty one leagues from the Casanare, is the Raudal of Cariven, where are those enormous rocks in the river which produce such strong currents from the north, that they endanger considerably the navigation of the Oronocco in that part.

There are some other missions on the banks of the Meta, besides those already mentioned. That of St. Rosalia is almost opposite to the mouth of the Pauto, on the south side. Macuco, near the torrent Orocue, is between the island Berrio and the river Cravo. Arimena, eight leagues from Buenavista; Cabiuna and Guacasia, near the torrents of the same name, ten and sixteen leagues from Arimena; all three on the south side of the Meta.

All these missions are under the care of the Friars of St. Austin of Santa Fè de Bogota, who exerting a most laudable zeal, have persuaded many of the savage Indians to live in

society. But notwithstanding the apostolic conduct of these missionaries, it often happens that the newly converted Indians abandon the villages, without any motive of discontent, and to the great regret of their pastors. It appears that they are induced to this conduct, from the remembrance of their first manner of living, which recurs to their mind with all the charms annexed to a wandering life in the most luxuriant forests. These emigrations sometimes take place without the previous knowledge of the missionaries, but very often they ask their permission, promising to come back after a certain number of sleeps, which is their way of measuring time. The example of the tribes who live unrestrained on the banks of the Oronocco and Meta, tends likewise strongly to promote these whimsical emigrations.

It is a subject of regret that the difficulties which Don J. Madariaga had to overcome, in a savage country, where the fear of being attacked by the Indians constantly alarmed his little suite, should have prevented him from exploring the banks of the Meta, and of the principal rivers falling into it. Being the rainy season when he sailed down the Meta, it contributed much to distract his attention, being obliged to be constantly alive to the dangers arising from the overflowing of this great river, which carried away woods in so great a quantity that it caused the wreck of some of his boats. The frequency of showers prevented likewise the landing of our travellers; yet notwithstanding this disadvantage, they had constantly the opportunity of observing the most luxuriant vegetation. The uninterrupted range of forests bordering the river, is inhabited by numerous species of birds, which by the brilliancy of their plumage, and the sweetness of their singing, enliven the solitary banks. The few plants cultivated by the missionaries grow luxuriantly; the rice, for instance, yields three harvests in a year, and Don J. Madariaga relates having seen a sugar cane eighteen inches in circumference.

Owing to the want of necessary instruments, Don J. Madariaga could not determine the positions of the most remarkable points on the Meta, but he was very particular in describing

its numerous islands, torrents, and rivers: as well as the hatos or habitations of the persons employed to guard the herds of cattle belonging to the creoles established in the missions. To the rivers and harbours not already distinguished by particular names, he gave those of his friends, and of persons most distinguished by their patriotism in Venezuela and New Grenada, offering by this means a praiseworthy tribute to merit and virtue. He likewise collected much information concerning the depth of the waters at different times of the year, measuring also their breadth, and sounding them in many places. According to his observations, the depth in different parts varies from four to eight fathoms, and the breadth from one mile to two and a half.

After having navigated the Meta, our travellers went down the Oronocco, to the mouth of the Apure; and then going up the Apurito, and the river Guarico, they landed at Calabozo, five days journey from Caraccas, to which place they proceeded some days after; and Don J. Madariaga presented to the government the journal of his travels, and likewise a scheme for facilitating commerce between Santa Fè and Caraccas, by the Meta.

Thus Don J. Madariaga has enriched geography with a map of one of the largest rivers that falls into the Oronocco, and has opened at the same time an easy and prompt communication between New Grenada and Venezuela.

London, the 16*th August*, 1816.

Art. XVII. *Some Account of* Tayloria Splachnoides, *a new Moss allied to the Genus* Splachnum. *By* William Jackson Hooker *Esq. F. R. S.*

Character of the Genus.

Peristomium duplex, *Dentes* 32, liberi, longissimi, tortuosi, per paria approximati, (siccitate reflexi madore arctè involuti.)

Character of the Species.

Tayloria splachnoides.

Plantæ gregatìm crescunt.

Caulis bi-trilinearis, erectus, simplex, parte inferiore radicibùs densè tomentosis, ferrugineis, intrafoliaceis obsitus.

Folia inferiora remota, *superiora* approximata, subimbricata, erecto-patula, ovato-lanceolata, apice magìs minùsve obtusa atque serrulata, reticulata, luteo-viridia, nervo infrà apicem evanescente concolore instructa. (Plate III. f. 4. 5.)

Folia perichætialia reliquorum similia, sed paululùm magis acuminata.

Seta terminalis, solitaria, subbiuncialis, gracilis, parùm flexuosa, basi amantiaca, nitida, supernè flavescens, atque in apophysin, capsula longiorem sed angustiorem, dilatata.

Capsula oblongo-cylindracea, primùm viridis, demùm flavescens. (f. 6.)

Calyptra nondum vidi.

Operculum conico-acuminatum, longitudine ferè capsulæ ejusdemque concolor. (f. 7.)

Columella capsulæ longitudinem excedens, filiformis, apice capitata. (f 6. 8. 9.)

Peristomium simplex; *dentibus* infrà marginem affixis, triginta duo, per paria approximatis, longissimis, attenuatis, tortuosis, rubris, transversìm striatis; madore arctè involutis, (f. 12.) demùm valdè mobilibus, vermicularibus, siccitate reflexis. (f. 10.)

This most extraordinary moss I first saw growing abundantly by the side of the magnificent *Glacier du Rhône* in

Switzerland. Notwithstanding the resemblance which its general habit bears to that of the genus *Splachnum*, its very long and narrow apophysis, and particularly its lengthened operculum, gave me reason to suppose, even at the first glance, that it would prove a new genus. But I had no opportunity of again examining it till some weeks after, when I gathered the same plant in a very elevated part of the Grimsel, near the *Hospice*, growing, as in the former place, though much more sparingly, among loose, schistose rock.

While examining my new discovery with the pocket lens, I observed that the teeth of the peristome, which had lain compactly involute in pairs a little way within the mouth of the capsule (forming a thickened ring or band as represented at f. 12.), were, by the warmth of my hand set in motion in a wonderful manner, every tooth writhing itself about with great rapidity, like a worm when suffering with acute pain. Nor did this movement cease till, by the continued application of heat, the capsule had become dry, was diminished in length, and the teeth were bent back over the edge of the capsule; but still variously twisted as shewn a f. 8. and 10.

At Bex, while looking over Mr. Schleicher's mosses, I recognized, amongst his doubtful species of *Splachnum*, the present plant, which that indefatigable botanist had gathered among the mountains bordering on the lower part of *Le Vallais*. I then pointed out to him the characters that I thought might serve to distinguish it from *Splachnum*; since which time I understand that he has mentioned it in his catalogue of plants on sale under the already preoccupied name of *Hookeria*. I likewise found it in the collection of my friend Mr. Leringe, of Berne; but without any name or notice of its habitat.

Previously, however, to my detecting this plant in Switzerland, Dr. Christian Schmidt, Professor of Botany at Christiana, who is now gone upon a hazardous expedition into the interior of Africa, had found it in one spot in Norway. Of this I was not aware till my return to England, when he kindly communicated specimens to me with the remark "Dentes peristomii longissimi, octo paria (?), torti, abrepto operculo,

valdè mobiles et mox inde reflexi." This observation, inaccurate in some respects, was made from specimens which were not sufficiently mature; but upon receiving others from me, he was satisfied of the goodness of the genus, and anticipated my own wishes in expressing a desire that it might bear the name of our mutual friend Dr. Taylor, than whom few have studied the mosses with more zeal, or with a fairer prospect of rendering service to the botanical world.

The subject of the present plate agrees with *Splachnum* in general habit, in the large reticulation of the leaves, in the capsule being provided with an apophysis, and in the exserted columella. It differs from all the known species of that genus in the long and acuminated operculum, in the great length and slenderness of the apophysis, in the insertion of the teeth some way within the margin of the capsule, and above all, in the number of these teeth, which are thirty-two distinct ones, but approaching each other in pairs, remarkably long, twisted, and having so extraordinary a vermicular motion, that I have been almost induced to include this circumstance as a part of the generic character. It is only when the teeth are perfectly saturated with moisture that they are rolled up with great regularity and compactness; and this is the best period to observe their true position, when they will be distinctly seen to be inserted in pairs. It is to be observed here, that without looking within the mouth of the capsule, this moss might be passed over for a *Gymnostomum*.

It is not a little remarkable that this moss should only have been discovered in places so distant from each other as Switzerland and Norway. In the latter country, Dr. Schmidt found it at *Tind*, in the province of Tellemark, in Christiansand, in latitude 60°. Probably the temperature of the air is nearly the same in the Swiss as in the Norway stations, since each spot, on the *Grimsel* and at the *Glacier du Rhône*, is elevated more than 5,000 feet above the level of the sea.

References to Plate III.

Fig. 1. *Tayloria splachnoides*, before the operculum is fallen, nat. size.

—— 2. The same with the operculum fallen.

Fig. 3.	A single specimen, magnified.	6
—— 4.	Leaf.	3
—— 5.	Leaf, to shew the reticulation.	2
—— 6.	Capsule from which the operculum has been removed.	3
—— 7.	Operculum.	3
—— 8.	An old and dry capsule.	5
—— 9.	Portion of a capsule, a part being removed to shew the interior sack and columella. f. *a*. the sack ; f. *b*. the columella.	3
—— 10.	A portion of the peristome as seen when the plant is dry.	1
—— 11.	Portion of the capsule in a state of moisture.	2
—— 12.	Upper part of a capsule, shewing the insertion and position of the teeth, and their remarkable involution when saturated with wet.	2

Art. XVIII. *On the Original Formation of the Arabic Digits.*

As we are informed that the Arabians were indebted to the Greeks for much of their science, more especially in the branch of mathematics, I would submit to the ingenious author of the third Article in the last Number, whether the Greek numerals will not supply him with the origin of the figures 7 and 9.

The Greeks represented 7 by ζ' or ς, and 9 by ϑ'. It is singular that these are the only instances, in which any similarity can be traced between the Greek and Arabic digits. From which circumstance, it might be inferred, that the Arabians substituted in both cases the Greek figures for their own, which were, perhaps, some awkward compounds of inferior numbers on the plan proposed in the article referred to.

M. R. I.

July 25*th*, 1816.

Art. XIX. *A new Mode of improving or mellowing Wine. Extracted from the German of* M. S. T. Von Soemmerring, *in the Memoirs of the Academy of Science at Munich.* June, 1814. Page 1—14. Quarto.

The improvement recommended to notice is, that wine should be kept in glass vessels having their orifices closed with bladder, as the means of mellowing or imparting to it the advantages of age in a short period of time.

The experiment chiefly founded upon is the following;

Four ounces of red Rhenish wine, of the growth of 1811, on the 21st of December 1812, were put into a tumbler of common white glass, three and a half German inches deep, and two inches and two lines wide. This was secured by a well prepared bladder softened by steeping, and placed on a shelf out of the reach of the sun, in a common sitting-room. The spaces comprised by two and four ounces were marked on the outside of the glass by lines.

The glass was opened upon perceiving that two ounces of the wine had escaped through the dry bladder, which was the case in the space of 81 days; and the following observations made upon the remaining wine:

1st. It was neither mouldy nor mothery, as it would have been had it been left uncovered, or even stopped with cork for the same length of time, in the same kind of glass, and in the same situation.

2. Dry chrystalline crusts or pellicles were perceived float- on its surface. These were found to be ordinary cream of tartar, from their sinking to the bottom on the wine being slightly shaken; from their being seen through a magnifier to consist of aggregated chrystals; by their reddish colour and semi-transparent substance: by their grating between the teeth; by the sour taste peculiar to that substance, as well as by their emitting the same smell as that when burning, and depositing the same kind of ashes. The quantity was too small for further chemical tests.

3. A cream of tartar precisely similar had subsided to the bottom of the glass.

4. The wine was of a darker colour, yet brighter and finer than the same sort bottled in the customary way, and which of course had ungergone no evaporation.

5. In smell, its flavour was stronger and more enticing than that of the same wine ordinarily bottled.

6. In taste, its flavour, though more spirituous and aromatic, was still, in another way, milder, softer, and more grateful to the palate, or in a word, mellower than that of the other.

7. Its proportion of alcohol was one half greater than in the ordinarily bottled wine of the same growth.

Wine concentrated in the same way was afterwards submitted to closer tests, and experiments were repeated on some of a different kind, but still red; and the above results were uniformly confirmed. Notice is given of experiments to be made upon a much larger scale, and some observations resulting from those already made are added, of which the following are a part.

It was known that water escaped through dried bladder; but that it did not admit an equally free and ready passage to the spirituous portion of wine as to the aqueous, seems a new and not unimportant discovery.

By this treatment of wine, no extraneous alterative is used, and it is left to rid itself spontaneously of the superfluous, coarse, sharp, sour salts, by the evaporation of the water in which they are held in solution.

Every one knows that wine left standing upright in a half-emptied bottle, either open or ever so well corked, for several weeks together, will spoil, and become mothery and sour. By closing the bottle with bladder, wine (red only has been tried) may be preserved under the same circumstances for a year together, without any such consequences. If the mouth of the bottle should not be larger than ordinary, we may be sure that in a year's time the quantity of half an ounce will not have been wasted, and the remainder not only be uninjured, but rather improved.

Thus, it cannot be denied, that dry cork is a very different guard to wine, from dry bladder.

The mellowness acquired by wine when kept in the cask, and which is ascribed to age, should seem to be an effect of the same cause, viz. the wine evaporating its watery particles through the wood, and depositing its salts on the sides in the shape of a film or concreted crust of various thickness.

Probably the spirituous particles of wine rise at the same time and in the same manner as the aqueous to the inner surface of the bladder; but the spirituous particles seem to meet with an opposition to their egress, not experienced by the aqueous. Thus we have in bladder a substance well adapted to separate spirituous from aqueous particles.

As the wine wastes by keeping in the wood, so fresh wine must be added to supply the waste, or else the whole spoils: this is not the case under the new treatment Wood lets out alcohol, the preserver of wine, along with water, but bladder does not.

Bladder keeps out the atmospheric air, so as to prevent fermentation and the turning of the wine to vinegar, which the dry staves of an half-empty cask will not do; and of course fermentation takes place in all casks of wine where the due replenishing is omitted.

Wine cannot receive from glass the taint which, it is well known, it will acquire when kept in wood, where occasionally both colour and taste are altered, and it becomes an infusion.

The degree of improvement or mellowness, which is induced in the wine treated as above in twelve months, is said to be equal to that which would be induced in the cask in twelve years. The shallower the glass, and the wider its orifice, the sooner the same effects are produced.

Another advantage is, that in the glass vessel we can always perceive the degree of evaporation that has taken place, and regulate the process at will.

It is suggested that some interesting results might probably arise from the examination of the gas found between the surface of the wine and the bladder, at different periods during the progress of evaporation.

Art. XX. *Analytical Review of the Scientific Journals published on the Continent, during the preceding Three Months.*

One of the principal objects we have in view in conducting this Journal, is to facilitate, by all the means in our power, the dissemination of scientific knowledge, derived from the labours and the researches of the learned of all nations. In pursuing this intention, it is but natural that we should wish to make our readers acquainted with the progress of science on the Continent, that in comparing the results of foreigners with our own, we may either derive a source of self-gratification, or a motive for further exertion. For this purpose we have resolved to give, in every succeeding Number, an analysis of the scientific journals published in those parts of Europe where science and the arts are most cultivated: we mean France, Italy, and Germany. The periodical publications of every country are the archives in which the learned and the philosophers hasten to deposit their discoveries and the results of their researches. We may, therefore, without much fear of being mistaken, form our judgment of the march of science from the contents of those publications. And as the difficulty and the expense of procuring every important journal from abroad is, and will for ever continue to be, great, our readers will applaud the resolution we have taken of giving them a periodical abstract of all they contain. Of course we do not pretend to give an account of every journal that is published on the Continent, nor of every memoir contained in these journals. They are too numerous, and the greater part of them too unimportant for us to assume so endless a task. It would be a waste of much valuable time, were we to notice all the trash that is daily pouring out of the periodical presses of the various countries in Europe. It will be sufficient for the end we propose to ourselves, to give an account of the different papers and memoirs that are to be found in those journals, which, from their high and lasting reputation, or from the well known merits of their editors and authors, deserve to engage our undivided attention. The arrangements we have made for

this purpose will, we hope, enable us to accomplish this important part of our engagements towards the public. We shall follow up this part of our Journal with a detailed account of the proceedings of the various public institutions of Europe consecrated to science, and our readers will see in the present Number the good result of the measures we have already taken on this subject, in the detailed account we have given of the proceedings of the Royal Academy of Sciences of Paris since our last Number. We shall also endeavour to give as accurate and as extensive a catalogue of foreign scientific works published during each preceding quarter, as we shall be able to procure through the means of our friends and correspondents.

Journal de Physique, par De la Métherie. *May and June.*

This Journal, like many others published in Paris, has occasionally been suspended or retarded in consequence of the political events that have lately disturbed France; nor is it likely to proceed much more regularly in future, from the additional stamp duty lately imposed upon all periodical publications. The Number we announce for May and June, was published in August, and no other has since appeared. It contains,

MAY.

Art. I. *Experiments on the mutual decomposition of Acids, and sulphuretted hydrogen Gas. By* Vogel.

The author had often observed that the concentrated sulphuric acid assumed a milky appearance when put in contact, however slightly, with sulphuretted hydrogene This phenomenon he first attributed to the presence of some portion of sulphureous gas, in the sulphuric acid. The experiments he made, however, to ascertain the truth of this surmise, proved on the contrary that the phenomenon arose from the sulphur proceeding from the decomposition of the acid. In this experiment the concentrated acid was boiled, that no trace of sulphurous acid might remain. The moment the gas came in contact with it, the decomposition took place; but much sooner when a current of the gas was made to traverse the sulphuric acid in a state of ebullition. In this case much sulphur was precipitated, and collected at the bottom of the vessel, under the

form of an opaque yellowish red paste, perfectly analogous to sulphur. When the acid is diluted the decomposition does not take place. The concentrated nitric acid offered the same results. In one of the experiments the acid was poured into a bottle containing some sulphuretted hydrogene gas. Sulphur was instantly precipitated, and volumes of nitrous gas extricated; in this instance also there was a double decomposition. The sulphuretted hydrogene gas and the phosphoric acid do not seem to have any action on each other. That of the boracic acid on the gas is equally inappreciable. In an experiment with sulphuretted hydrogene gas, and chlorine, the author obtained a decomposition of the former, and a dense brownish liquid analogous to the oxi-sulphuric acid of Thomson. There is also reciprocal decomposition between the arsenic acid and the sulphuretted hydrogene gas. If a concentrated solution of the former be poured into a vessel containing the gas, a precipitate is instantly formed, which is a yellow sulphuret of arsenic. This decomposition takes place even when the arsenic acid is greatly diluted. The experiments with the carbonic acid proved that the two bodies have no action on each other. The sulphuretted hydrogen gas is decomposed at a high temperature.

Art. II. *On the Influence which the Abortion of the Stamina seems to have on the Perianth.*

This paper, highly ingenious, though perhaps not of a nature to be readily approved of by the older botanists, was read by Mons. H. Cassini, at the Philomathic Society of Paris, and is inserted in the Bulletin of Sciences published by that scientific body. We shall have occasion to speak more at large on this subject at a future period.

Art. III. *Mémoire sur la Montagne de Sel gemme de Cardonne en Espagne. By* L. Cordier.

In de la Borde's Voyage through Spain, there is an account of this remarkable mountain, with a plate of it, both which are inaccurate, M. Cordier having examined it particularly, and as a geologist, gives a detailed and scientific description of it, presenting some highly interesting geological facts. The town of Cardonne, from which the mountain in question has taken

its name, is situated on an elevated ground, in the interior of Catalonia, sixteen leagues from Barcelona, and fourteen from the central range of the Pyrenées. Its elevation above the level of the Mediterranean is 1404 feet. The mountain of salt is about the size and figure of Montmartre near Paris; it presents, however, several sharp points, perpendicular cuts, and other marks of decomposition. In some parts it is covered by an accumulation of alluvial soil. The almost total absence of vegetation on the mountain renders its examination and that of its structure, very easy. From the results of M. Cordier's observations, it appears that the rocks composing the mountains may be divided into seven principal ones, namely, 1. pure muriate of soda in small masses, with large grains semitransparent and colourless; 2. idem, in small roundish masses, with minute grains more or less transparent, occasionally of a grayish colour, reddish white, flesh colour, violet, and reddish brown; 3. impure muriate of soda in roundish masses with blue clay, and common selenite in small crystals. This mixture gives the rock a porphyroide appearance; 4. pure muriate of soda in concrete tubercular masses, with a granulated fracture, fully transparent, of a yellowish white colour, and more commonly of a snow white; 5. gray and blue clay; 6. common gypsum; 7. idem, mixed with anhydrous selenite. The extraction of the salt is made in the open air, by horizontal cuts in the form of steps. From the mine the salt is carried by mules to the government store-houses, from whence it is sold to the annual amount of a million of francs, without any other preparation.

Art. IV. *Mémoir relatif à l'influence de la Temperature, des Pressures mécaniques, et du Principe humide, sur la Génération du Pouvoir électrique et sur la Nature negative ou positive de l'Electricité. By* Dessaignes.

The paper, from its length and the nature of its subject, is not susceptible of abridgement, as it chiefly consists in experiments and practical illustrations of a particular theory on electrical phenomena. The author has divided it into three parts, each of which is appropriated to the detail of particular

experiments, facts, or observations. In the first part, the phenomena which a glass rod, plunged into mercury, present, are described; these phenomena are of three sorts; according as the tube or rod has been placed in contact with the mercury only, gently immersed, or, suddenly plunged into it. In each of these three cases the rod becomes differently electrified. The author distinguishes the first state of electricity, by the name of contact—the second by that of *immersion*—the third by that of shock. The second part of the Memoir, relates to certain observations serving to explain and determine the circumstances which render the glass rod plunged into mercury, susceptible of so many variations with regard to its electricity. The influence of the humid principle, and of caloric on the exhibition of the phenomena alluded to, is here particularly examined; and the conjectures formed by the author to explain the various phenomena he had observed, are confirmed by what he states to be positive facts, all tending to prove his favourite theory; namely, that there are not two distinct electric fluids, as hitherto supposed, but that a fluid, eminently expansive, pervades and penetrates all bodies to which it is united by a peculiar attractive force, forming around them a kind of electrical atmosphere. This fluid is subject to the influence of external pressure; when the latter diminishes, the expansive force augments, and the fluid acquires expansion; these two effects, however, are not produced in the same ratio. The external pressure, after having diminished may again encrease more or less gradually: in this case, the expansion of the fluid diminishes as well as its expansive power, though not always in the same ratio. Two homogeneous bodies cannot be electrified by each other, because their powers being subject to the same laws of encrease and diminution—there is between them a constant equilibrium of tension, even under the pressure produced by friction. Mechanic pressure is not the only existing cause of the electricity of bodies. It may be produced by the simple contact of two homogeneous bodies, by the movement of their temperature, when the equilibrium between them is broken, or by the change which their different attractive powers give rise to.

Art. V. *Mémoire sur la Reduction des Degrés de Chaleur, &c. Memoir on the reduction of the degrees of heat marked on the Thermometrical scales of Deluc and Fahrenheit, to the degrees of a scale intended to mark the equal differences of heat.*

This paper, by *Mons. Flaugergues*, is a Supplement to a former one published in the Seventy-seventh volume of the Journal by the same author, and in which he endeavoured to prove, that the fact observed by several philosophers, respecting the unequal expression of the degrees of heat by the equal divisions of a thermometer, is a necessary consequence of the general mode, in which bodies are dilated by the addition of caloric, and not the effect of any particular quality of the fluid employed, as those philosophers have pretended. As such, therefore, it does not admit of abridgement. It contains an acconnt of two other experiments made in the pursuit of the same subject, with further explanations of the author's theory respecting it; and some tables, with direction for calculating by means of them, the reduction of thermometrical degrees of Fahrenheit's scale in equal differential degrees of heat.

Art. VI. *Lettre de* M. de Heliz *à* M. Delametherie *sur les phenomenes électriques.*

This relates to some alteration made in the common plate electrical machine, and is illustrated by a plate.

Art. VII. *Observations sur les feuilles du Cardamine pratensis, par* H. Cassini.

M. Cassini mentions, in opposition to what M. Richard has asserted, that the leaves of plants are susceptible of germination, and he brings forward, to prove this, the plant mentioned in the title of this paper. He has often had occasion to observe, that some of the petioles of the terminal leaflets of the radical leaves, changed their tubercles into a real bud, shooting forth a stalk with leaves upwards, and a real root downwards.

JUNE.

The first paper in this Number is the third part of the Memoir on electricity, which we have alluded to.

Art. II. *Observations sur la Filiation des Animaux depuis le Polype jusqu'au Singe. By* De Basbançois.

The system of animal *genealogy*, published by Lamarck, in 1809, in his *Philosophie Zoologique*, has suggested the remarks contained in this paper. The system is founded on the supposition that all animals owe their origin to the successive developement of a FIRST organic being. To illustrate this, a plate is given which is something like a descending genealogical tree, beginning with the microscopic insects found in venegar and stale water, and ending with the African orang-outang. The former have produced the polypi, these the medusæ and the calcareous madrepores—next the radiatæ, the insects without wings—the moluscæ—the fishes—the reptiles—the amphibious mamiferous animals—the land quadrupeds—the cheropteri—the snakes—the monkeys, and lastly, the ourang of India and Africa.

Art. III. *Lettre de* M. Delezennes *sur la Circulation du Fluide électrique.*

The author has repeated M. Erman's experiments with the humid voltaic pile and the dry one, to prove that the electric fluid in the former, circulates with rapidity and regularity, while on the contrary, the circulation in the latter is slow and irregular. Upon this he gives his particular opinion as to the cause of such difference, and attempts to explain the various phenomena which take place in making the experiments alluded to.

Art. IV. *Meteorological Observations made at the Observatory of Paris, for May,* 1816.

Art. V. *Rapport fait à l'Institut, d'un Mémoire du Général Andreossy sur l'Irruption des Eaux du Pont Euxin dans la Mediterranée. By* Barbié de Bocage.

Count Choiseul-Gouffier, a name well known in Literature and the Fine Arts, employed, while residing at Constantinople in the quality of French ambassador, a person named Kauffer, to draw a plan founded on astronomical observation, of the Thracian Bosphorus, M. Laffitte-Clavé had done the same thing as far as relates to the entrance into the Black Sea.

General Andreossy, who was the last Ambassador that represented Bonaparte at the Porte, took occasion from the above two operations for investigating the subject farther—and uniting to the best and most favourable means, much zeal and real knowledge; he has extended his researches to many geological points connected with the question,—has collected many specimens which he has deposited at the School of Mines, in Paris, and finally completed several drawings and a map founded on barometrical and geodetical calculations. The present report, however, refers simply to that part of the General's Memoir, in which he describes minutely, the method by which Constantinople has been, and is now supplied with water, and where he gives an account of several interesting objects of antiquity and the Fine Arts, many of which he drew in the most skilful manner. Amongst them is a drawing representing the three artists, (two of whom were English) who discovered the Ægina Marbles, paying a visit to the Aga of Athens, with a view of bargaining for the permission of taking advantage of their discovery.

Art. VI. *On the primitive Matter of Lavas. By* De Luc, *jun. of Geneva.*

The author of this interesting paper, combats the generally received opinion respecting the formation of lavas. He denies that any fact hitherto known authorises us to class lavas amongst rocks; and pretends that the matter of all lavas, is a mixture of water, muriate of soda, sal ammoniac, iron, sulphur, silica, alumina, &c. in a state of powder, or of solution. The pyroxenes, the amphigenes, the laminæ of feldspath, the peridot, and in general all the crystallized bodies found in the above mixture, were formed at an epoch more or less remote, independent of it; and when the mixture in which they are contained, undergoes an igneous fusion—these small bodies remain enveloped in it without being fused or decomposed, the heat being insufficient for that purpose. If to this view of the formation of the primitive matter of lavas, we add the possibility of the sea water charged with muriate of soda, penetrating to where the mixture lays, by which a sort of fermentation is produced, necessarily accompanied by much extrication of

heat; we shall have an idea of the principles on which the author has formed his notions on volcanic eruptions.

Art. VII. *A Report made to the Institute on a Sketch of Military and Naval Architecture during the Eighteenth and Nineteenth Century. By* M. Dupin.

A report on a printed work is a kind of review or critique of it, made by the Commissaries appointed for that purpose by the class. The opinion of these gentlemen, in the present instance, is favourable to the author. They consider it as a very useful elementary book for those who are engaged in ship building.

Annales de Chimie et de Physique. By Mess. Gay Lussac *and* Arago.——*May.*

We prefer beginning our analysis of this valuable Journal from the present Number, because it is the first of a fresh volume, namely, the second of the new series.

Art. I. *Suite d'une Classification naturelle pour les Corps simples par* M. Ampere.

Our readers will see from the enunciation of this title, that we cannot attempt to give an account of this paper, without first having laid before them, an abstract of the preceding ones, which together, form a complete and a new system for the classification of simple bodies. We may be tempted to do this at a future period. The speculations even of such a man as Ampere, deserve the attention of the learned, and we shall feel it our duty to notice them in time. We only wish that the author could be prevailed upon to give up his intention of coining new and hard names for the combinations of simples, which far from promoting science, tend to impede its progress, by rendering it mysterious, and unintelligible.

Art. II. *Extract of a Memoir of* M. Beudant, *read before the Institute, on the possibility of rearing the river Molusca in salt water, and vice versa.*

The object of Mons. Beudant in undertaking the experiments which gave rise to, and are detailed in, the Memoir, was princi-

pally to explain certain remarkable geological facts, and particularly the mixture of marine shells, with fresh water shells in the same rock, discovered by M. Beudant himself in 1808, at Beauchamp, and more recently in the valley of Vaucluse. When the passage from the fresh to the salt water is immediate, the river Molusca dies in a few minutes. The same occurs when they are plunged into water charged with selenite, sulphate of iron, mineral acids, or saturated with sulphuretted hydrogen gas. But when the experiment is made by placing the river Molusca in water, containing a grain of salt only for every pound, and the quantity is gradually encreased to 0,04 of its weight of salt, the fish lives, and seems to accustom itself to its new element. Some experiments, made with similar caution, by gradually diluting the sea water in which marine moluscæ were placed, till it had become almost fresh, proved also that the latter animals can accommodate themselves to the change, and live in apparent ease. The experiments having been repeated on a great number of individuals, and the results having been always the same, there is every reason for admitting the truth of the inferences which the author has deduced from them, and his mode of accounting for the mixture of marine and river shells in the same rock.

Art. III. *Ecperiments on the Chemical nature of Chyle, &c. &c. by* Dr. Marcet. Extracted from the Sixth Volume of the Medico-Chirurgical Transactions.

Art. IV. *Traité de Physique Experimentale et Mathematique, en 4 vol. 8vo. par* M. Biot.

This is a short review or account of the work thus announced, by Berthollet. As it is our intention to review the work on the first opportunity, we shall only say at present, that the eminent chemist who has announced it to the French public, passes a very high and flattering encomium on this philosophical publication.

Art. V. The Same as Art. IV. of *Journal de Physique.* Month of May.

Art. VI. *Sur les Piles sèches voltaiques.*

This Paper contains an historical sketch of the invention of what is improperly called the dry galvanic pile. As usual, we have a claim of priority brought forward in favour of the French chemists. It is pretended that Messrs. Hachette and Desormes, and not De Luc, or Zamboni, are the real inventors of this Voltaic arrangement. The futility of such a pretension is so glaring, that we have only to read an extract of the report made by Morveau, and others, on the pile constructed by Hachette and Desormes, to persuade us that the claim is unfounded. The report concludes with this expression: "the quantity of electricity evolved in this pile, diminishes in proportion as the starch-glue, with which it is constructed, gets gradually dry." A column into the composition of which a substance is introduced which is said to become gradually dry, and hence to lose its electricity, cannot be a *dry* voltaic pile in the first instance. As to the observations of several sçavans on the action of De Luc and Zamboni's piles, quoted in this paper, they are really too irrelevant to deserve repetition. We have ourselves made some experiments on Zamboni's pile; but the results have been so various, and so irreconcileable with each other, that we will not venture thus hastily to form a theory, or oppose the already received one. One fact we will mention as certain, the continued action of two considerable piles of Zamboni has produced amongst many electrical phenomena, one chemical effect, namely, the abstraction of nineteen parts of the oxygen present in the portion of the atmospheric air in which the columns had been hermetically confined, and the cessation of all electrical phenomena, and of all oscillations in the pendulum after the absorption of the oxygen. We shall also venture to assert, from what we have observed, that the oscillations of the pendulum are not in the least affected by atmospherical modifications, and that therefore the pile cannot be considered either as a barometrical or a hygrometrical instrument. The oscillations in our case were twenty-two in a minute (the columns

being placed at the distance of six inches from each other), and continued at the same number till the moment when they ceased altogether, the pendulum remaining in a perpendicular position, and not, as some have asserted, leaning towards either of the poles. On a repetition of the experiment, when the oscillations had stopped, we cautiously admitted a fresh supply of atmospheric air without moving the apparatus: the pendulum was instantly attracted to the positive pole, and the oscillations renewed in the same number and progression.

Art. VII. *Extrait des Séances de l'Academie Royale des Sciences.*

This account of the proceedings of this class of the Institute, refers to a period remote to be interesting. We therefore omit it with little hesitation, having, in another part of this Number, given an account of the proceedings of the class, down to a very late period.

Art. VIII. *Sur l'Altération qui éprove l'Ether sulphuric.*

M. Gay-Lussac has accidentally observed, that when sulphuric ether is kept for a considerable length of time without being disturbed, acetic acid, perhaps some alcohol, and a particular oil, are formed from its decomposition,

Art. IX. *Sur la précipitation de l'oxide d'or par la potasse. Par* M. Figuier. (See our analysis of the Journal de Pharmacie.)

Art. X. *Table Metéorologique.*

JUNE.

Art. I. *Suite d'une Classification naturelle, &c.* (See the note to the first article in the Number for May.

Art. II. *Note sur une Matière renfermée dans un Kyste qui se trouvait attaché au bord libre du Foi dans le cadavre d'une femme agée d'environ 60 ans.*

The cist here alluded to contained a pulpy matter in considerable quantity, interspersed with solid, hard, and concrete lumps. Part of the soft substance was extremely fetid, and in a state of incipient putrefaction. Treated three or four times with fresh alcohol on a sand bath, it yielded, on cooling, some lamellar crystals resembling the adipocire of the biliary calculi. The solid lumps were afterwards pulverized having become quite

dry and brittle, and submitted to the action of fire in a platina crucible. They lost in every 100 parts, 22 of combustible matter; the remainder was chiefly phosphate of lime. This tumour, therefore, differs essentially from the steatome, which abounds in sebaceous matter.

Art. II. *Note sur la Dilatation des Liquides. Par* M. Gay-Lussac.

In order to observe afresh the expansion of fluids, the author contrived a simple apparatus, consisting of a glass tube, terminated at one end by a ball. The tube is graduated with equal degrees representing volumes. It is filled with mercury, which is boiled with a view of extricating all the air, and then weighed to ascertain the capacity of the apparatus into which the liquid whose expansion is to be examined was introduced, and the open ends of the tube hermetically closed. The ball is then plunged into water of various temperatures, and the march of this thermoter was compared with that of a mercurial thermometer plunged into the same water. The results of these observations are given in appropriate tables, calculated according to the formulæ $c = At + Bt^2 + Ct^3$, proposed by Biot. A very remarkable fact is mentioned, namely, that alcohol and sulphuretted carbon give the same volume of vapour, and possess an equal expansibility.

Art. III. *Expériences Galvaniques curieuses. Par* M. Porret, jun.

This article is taken from the Annals of Philosophy, July 1810,

Art. IV. *Extrait d'un Mémoire les sur Combinaisons du Phosphore avec l'Oxigene. Par* M. Dulong. *Read before the Institute* 15*th July*, 1816.

The principal object of this Memoir is to prove, that there exist at least four distinct acids formed by the combination of phosphorus with oxygen. The acid formed by the minimum of oxygen, which the author calls *hypo-phosphorous* acid, is produced by the reaction of water on alkaline phosphurets. This acid unites readily with various bases, and forms hypo-phosphites, remarkable for their extreme solubility. The *hypo-phosphite* of potash is deliquescen tin a higher degree than muriate of lime. These salts absorb slowly the oxygen of the air, and become

acid. They are decomposed by heat. The second acid is that discovered by Sir H. Davy, for which our author continues the name of *phosphorous acid*, but for which he proposes, that of phosphatic acid. Next comes the phosphoric acid. The composition of these various acids is given according to the principles of definite proportions; but the author's researches on the subject being yet unfinished, no mention is made of the fourth acid. In a note annexed to this paper, M. Dulong protests against the style of the review we have given of Berzelius's attempt at forming a *simple* system of *scientific* mineralogy. We indeed find that the French chemists have of late adopted the fashion of admiring every thing that proceeds from the Swedish chemist, whose abilities we acknowledge and revere; though we shall ever continue to protest against those whimsical innovations which called for censure in the article alluded to.

Art. V. *Mémoire sur la Composition des Acides phosphoriques et phosphoreux, &c. Par* Berzelius.

We shall perhaps have occasion to say something on the subject of this paper, the extreme length of which precludes us from giving a fair analysis of it.

Art. VI. *Expériences pour déterminer la Quantité de Strontiane contenue dans plusieurs espèces d' Arragonite. Par* MM. Bucholz *et* Meissner, *from Schweigger's Journal.*

The question, whether or not arragonite is a chemical compound of lime and strontian was, as we supposed, set at rest by the analytical experiments of Stromeyer. The anomalies, which the arragonite presented in crystallography, when considered as a simple carbonate of lime, had induced that chemist to undertake the inquiry into its composition; and he thought he had found an explanation of the problem in the presence of strontian, which he considered to be united to the carbonate of lime, not as a mixture, but chemically, and in atomic proportions. The results of the authors of the present memoir, however, tend to disprove such a conclusion. They analysed twelve species of arragonite, and amongst them those already examined by Stromeyer and Gehlen, and from their experiments it

appears that there are some which contain strontian, and others none; that in the former the strontian is in very small proportion, and cannot be considered as the immediate cause of the anomalies presented by crystals of arragonite considered as a simple carbonate of lime; and lastly, that in the species not containing the smallest trace of strontian, the same essential mineralogical characters are found, which belong to the former. These results prove that the carbonate of strontian is purely accidental in arragonite, and cannot influence its crystalline modifications.

Art. VII. *Sur l'Acide nitreux. Par* Gay Lussac.

The author of this short note had published in the first volume of the *Annales de Chimie*, (new series) a paper on the combinations of azote with oxygene, in which he asserted the existence of two distinct *nitrous* acids. Dr. Thomson disputed the claim of G. L. to this discovery, and asserted (vide Ann. of Phil. VIII. p. 71), that he had long before mentioned the distinction between nitrons acid and nitrous vapour; and had also inserted in his list of atomic weights in the same Journal, the proportions of the various combinations of azote and oxygene, since given by M. Gay Lussac. The latter, however, defends his claim to the discovery, to which he is far from attaching much importance, in an open manner, and challenges the Doctor to prove, in a direct way, and not in a vague manner, the justice of his pretensions.

Art. VIII. *Extrait d'un Mémoire de* M. Leopold de Buch *sur la Limite de Neiges perpétuelles dans le Nord.*

This Memoir, read to the Institute in March 1810, has since been published as an appendix to the French translation of this author's travels in Norway and Lapland.

Art. IX. *Extrait des Séances de l'Academie Royale des Sciences.* (See our note to a similar article above.)

Art. X. *Note sur les Variations du Gaz acide carbonique dans l'Atmosphère, en Hiver et en Eté. Par* J. Saussure.

This memoir is extracted from the Bibliotheque Universelle.

Art. XI. *Note sur l'Huile du Gaz oléfiant.* *Par* MM. Robiquet *et* Colin.

The object of this note is to prove that the oil obtained from the olefiant gas is a distinct substance from the hydrochloric æther with which Berthollet and Thenard have confounded it. The authors establish the distinctive characters of the two substances in a masterly manner, and prove that the hydrochloric æther is a combination of equal proportions in volumes of surcarburetted hydrogen gas, and muriatic acid gas; while the æther of the olefiant gas results from the combination of equal volumes of chlorine, and surcarburetted hydrogen gas. The latter substance, therefore, enters into the composition of the hydrochloric æther, in a greater proportion than in the oil, in question; and neither contains the smallest particle of oxygen.

Art. XI *Quelques Remarques sur un passage de la Bibliothèque Universelle.*

This article is personal to the editors of the Annales de Chimie. It cannot be interesting to our readers. The same may be said of the last article in this number.

Art. XII. *Observation sur l'Æther sulphurique.*

The note inserted by Gay Lussac in the number for May, respecting the decomposition of sulphuric æther, has induced M. Planche, an apothecary in Paris, to bring forward a claim of priority to the observation of that phenomenon. His remarks on the formation of acetic acid from sulphuric acid kept a great length of time, were inserted in Brugnatelli's Pharmacopœia, edition 1811.

Journal de Pharmacie et des Sciences accessoires. Par Mess. Cadet-Planche, Boudet, Pelletier, Virey, &c. *June* 1816.

Art. I. *Nouvelles Observations sur la précipitation de l'oxide d'or par la potasse et sur l'administration du muriate triple d'or et de soude. Par* M. Figuier, *Professeur de Chimie à l'Ecole de Montpellier.*

This is altogether an interesting paper. MM. Vauquelin, Duportal, and Pelletier, had stated that a solution of gold was not precipitated, when cold, by the alkalies; and M. Oberkampf mentioned that having obtained a precipitate from a solution of gold by an alkali, he ascribed it to the formation of a large quantity of a triple salt, not decomposable, owing to an excess of acid in the solution. The object of M. Figuier therefore is to prove that the precipitate in the latter case is an oxide of gold, that the excess of acid does not impede a precipitation of the oxide by an alkali, and that the same quantity nearly of the precipitate is obtained with a neutral solution. The author then proceeds to give his method, and to detail the experiments which led him to these conclusions; he afterwards passes on to the consideration of the triple salt of gold, and gives the following conclusions. 1. That a solution of muriate of gold with an excess of acid gives, with potash, a quantity of the oxide nearly equal to that obtained from a neutral solution; 2ndly, that the triple salts of gold can be decomposed by an excess of their basis; 3dly, that these same salts can be equally decomposed by an excess of different bases; and lastly, that of all the alkaline bodies, lime, in equal weight, decomposes the greatest quantity of neutral muriate of gold.

Art. II. *Formation du Sucre dans les graines céréales converties en Malt, &c. By* M. Kirchoff.

This is the same gentleman who some years ago published a paper on the mode of changing the fecula of grains into sugar, by sulphuric acid. He now announces another discovery, that of changing fecula into sugar by means of gluten, a fact which if realized, cannot fail to prove of the utmost importance with regard to the general theory of fermentation. In the course of his observations M. Kirchoff remarks how readily Saussure, Hermbstaed, and Thomson fell into error respecting the formation of sugar after fermentation. None of the facts confirms their theory, particularly that of the latter chemist, which is in direct contradiction to experience. The author draws the following conclusions from his enquiries. 1. Sugar is formed in germinating grains and in flour infused in hot water, by means of

the gluten; 2. the fecula does not undergo any change in the germinated grains; and it is only at a temperature above 40° of R. that the gluten changes the fecula into sugar; 3. the fecula is of all constituent parts' of flour that which most essentially serves for the formation of alcohol; 4. by germination, the gluten acquires the property of converting into sugar a greater quantity of fecula than is present in the grain; 5. the formation of sugar in grains after germination is a chemical process and not the produce of vegetation; 6. the fecula in a decoction of malt is in a state of sugar, and in this state the infusion of gall-nuts has no action upon it.

Art. III. *On the Refining of Sugar.*

The editors of the Journal de Pharmacie had announced in one of their preceding numbers, that a gentleman at Martinique had devisód a method of refining syrup by means of a small quantity of the powdered bark of the *Ulmus pyramidalis.* This was a mistake; to rectify which is the object of the present note. It appears then that the bark employed is that of the *Theobroma guazuma*, (*Cacaoyer faux*) which grows in abundance at Jamaica, whence it was brought by some inhabitants of Guadaloupe and Martinique.

Art. IV. *Notice sur de nouvelles Préparations d'Ipécacuanha, de Quinquina, et de Rhubarbe.*

The French apothecaries are very fond of multiplying their pharmaceutical preparations. The reason is, that the physicians yielding to the innumerable caprices of their patients, prescribe the most simple medicines under various forms *de luxe*; and it is to accommodate themselves to this mania, that the apothecaries are at the trouble of inventing new formulæ and preparations. The present paper furnishes an example of this foolish spirit of innovation. We have a new *tincture* and a *sugar* of *ipecacuanha*; a new *tincture* and a *sugar* of bark; a new *tincture* and a *sugar* of rhubarb. This is the mischief of having no regular pharmacopœia, an inconvenience for which a late decree of the king has however provided.

Note. The three next articles of this Number are not worth quoting.

Art. VIII. *Sur la Découverte de la Vaccine.*

The French are a queer people. We have discovered, and propagated the cow-pock for more than twenty years, and as long as it was a matter of problem, whether it would or would not succeed, the French continued to ridicule the idea, and strongly opposed the truth advanced by Jenner and his friends. But all doubts are now removed; the cause of humanity triumphs; mankind has received at the hands of an Englishman, one of the greatest blessings that could be bestowed upon them, and our nation seems to derive additional lustre from it; a Frenchman now starts up and tells us that the discovery belongs to France, and that we became possessed of it by a certain talent, inherent in us, of appropriating to ourselves every thing, that has been done by others, without saying "thank you;" hence, by means of this talent, we have robbed Mons. *Pascal* of the hydraulic press; M. *Dalenne* of the steam-engine; M. *Lebon* of his thermolamp; M. *Montalembert* of his sea-carronades; M. *Morveau* of his fumigations; Mons. *Curaudau* of his theory of chlorine, and even poor *Molière* of two of his comedies. The story of the Vaccine is very pleasant; and considering that it comes immediately from M. *Chaptal*, who communicated it to the *Société d'Encouragement*, we know not whether to laugh or to be angry. It appears then, that a M. *Irland* of Bristol fell sick, and took it into his head to travel thence to Montpelier. M. *Irland* took with him a M. *Pew*, a surgeon. M. *Pew* met and spoke to a M. *Rabaud*, Protestant minister of Montpellier; M. *Rabaud* mentioned to M. *Pew* that there was a disease of the cows at Montpellier, called the *picotte*, and asked whether it might not be used as an antivariolous remedy. This *picotte* remained in M. *Pew's* head till his return to England; there he saw Dr. *Jenner*, to whom he imparted the *picotte*. *Jenner* soon found the *picotte* in Gloucestershire, and imparted it to little children who had not had the small pox; and hence the discovery of the vaccine, the honour of which does not belong to England, but to Montpellier, and by *ricochet* to M. *Rabaud*. This is really too bad!

Art. IX. *Extrait d'une Lettre de M.* Pechier *de Geneve à M.* Boullay, *Pharm. à Paris.*

We shall have occasion to speak of the subject of this paper in another part of our analysis.

Art. X. *Traité de Physique expérimentale &c. 4 vol. par Biot.*

See our note to this title under the article "Annales de Chimie."

Art. XI. *Essai sur les propriétés medicales des plantes comparées avec leurs formes extérieures et leur classification naturelle. By* Decandolle.

We like much the practical facts of this work, greatly enlarged in the present edition. The theory which serves as a vehicle for them is very old; M. Decandolle is not the first who formed an analogy between the external forms of plants, and their qualities; many of the ancients have done so before him, and like him, they were all mistaken.

Art. XII. Variétés. *Note sur la Découverte du Sel ammoniac factice. Par* M. Planche.

The author has found by chance a Latin book printed in 1679, by a Dr. Pielat, a Dutchman, in which there is a method of obtaining artificial sal ammoniac from bones, similar to that the merit of which has generally been ascribed to Geoffroy, who published it in 1719, that is forty years after.

Art. XIII. *Sur les Hospitaux militaires d'instruction et l'enseignement des Pharmaciens militaires.*

We cannot enter on this subject, entirely national.

JULY.

Art. I. *Quelques expériences sur l'écorce du Cinchona Condaminea* Humb. *et* Bonp. *Cascarilla de Lox des Espagnols. Par M.* Laubert.

The author made some experiments on this bark with sulphuric ether. The tincture resulting from it seemed to hold in solution two distinct substances, the one green, the other whitish, but tinged with red by a third body, which seems to

partake of the nature of the volatile oils. M. Laubert did not examine particularly these three substances, of which he intends giving a more detailed account hereafter. It does not appear that the author has proposed any practical point in his present researches.

Art. II. *Extrait d'une Thèse sur le Mercure et sur ses Combinaisons avec l'oxygene et le soufre. Par* M. Guibout.

This is a practical memoir of much importance. We shall make our readers better acquainted with it, when concluded in the original.

Art. III. *Matière medicale des Galibis et des Guaripous, peuples naturels de la Guiane.*

In a country where the vegetable productions of nature seem prodigally multiplied, and grow luxuriantly around every man's cot, impregnated with strong aromas—charged with energetic sapidity—and known to possess great powers on the animal system, it is not surprising that the list of remedies even among a savage people should be long and multifarious. Hence we are not astonished to see in the present Memoir an enumeration of more than 150 plants, divided into classes, according to their prophylactic and therapeutic virtues. Whether the *peuples naturels* of the Guiana can distinguish the *antiscrophulous* from the *antipronics*, and the latter from the *antiherpetic* plants; whether, in fact, their knowledge of materia medica is so far advanced as to form such a number of classes of medicines, arranged according to their virtue, as the French author of this Memoir pretends, is another question, and one which we shall not venture to decide.

Art. IV. *Recherches géoponiques sur la plus simple analyse des terres arables. Par* Cadet de Gassicourt.

We may be tempted to say something on this paper hereafter.

Art. V. *Lettre du Docteur* Rein *à* M. Gilbert *sur l'Alcornoque.*

The Martinique gazette announced some time ago the application of a new remedy in certain diseases. This remedy is the

root of an unknown tree called *Alcornok* by the Indians. The results of Dr. Rein's analysis are the following.

Specific gravity 1,970.

The ligneous part is composed of

Gum	105
Extractive matter . .	102
Resin . . .	54
Humidity . . .	136
Vegetable fibre . .	303
Tartaric acid . .	a trace
	1,000

the humidity is without smell, the extractive matter of a pure bitter taste, and the resin without any particular flavour.

Art. VI. *Nouvelles de Sciences.*

Art. VII. *Avis aux Souscripteurs.*

One of the most agreeable articles in the Number, since it announces, that in consideration of the anxious wish of the subscribers, the Journal, which was to have been suspended on account of the new tax, will continue to be published till 1817.

Bulletin di la Société Philomathique de Paris.

JULY.

Art. I. *Sur les Combinaisons de l'Azote avec l'Oxygene.* Par M. Gay-Lussac.

The subject of the present paper has been laid before the public in this country by Dr. Thomson, in his Annals of Philosophy, and even controverted; a circumstance which called forth the reply from the author, noticed above.

Art. II. *Nouvelles épreuves sur la vitesse inégale avec laquelle l'électricité circule dans divers appareils électromoteurs.* Par M. Biot.

The ideas respecting the unequal transmission of electricity in the voltaic pile, set forth in this Memoir of M. Biot, have

been explained by him in a public course of natural philosophy recently given; and likewise published in his *Traité de Physique*. He has endeavoured to explain why a pile after having effected certain energetic decompositions soon loses its chemical power, although it retains the faculty of charging the condenser with the same energy, and almost instantaneously. He ascribes the cause of this phenomena to the inequality in the initial degrees of quickness with which the various piles, or the same pile at various epochs, charge themselves after having once been discharged. In support of this theory M. Biot made some experiments, first with a pile of copper and zinc placed between disks of fused nitrate of potash, and next with two piles of *Hachette*, the conducting medium of which is a starch-glue, as we had occasion before to mention, between the two poles of which he placed a piece of alkaline soap. In this case the chemical action of the piles is fully effective, while its action on the condenser is $= 0.$; whereas if the conducting medium in the piles be made of a solution of muriate of soda, the electrical effect on the condenser will be lasting and powerful, while the chemical action becomes weak after the first discharge. This is perhaps the place for mentioning a curious phenomenon, which has repeatedly occurred to us with regard to a voltaic battery strongly charged, and so as to ignite readily a platina wire of two lines in diameter. After the first ignition, which was complete and instantaneous on forming the circle, we have never been able to obtain a repetition of it with the same battery, though the trials succeeded each other rapidly.

Art. III. *Nouvelles Expériences et Observations sur les rapports qui existent entre le système nerveux et le système sanguin. Par* Dr. Wilson Philip.

This Memoir is extracted from the Philosophical Transactions of last year.

Art. IV. *Sur le jeu des anches. Par* M. Biot.

This paper can interest but a limited number of persons. It relates to the mode in which sound is generated in those wind

instruments, the mouth-piece of which is composed of two elastic laminæ, whose vibrations and percussions against each other are the cause of the sound of those instruments. The Memoir was read before the Institute.

Art. V. *Note sur le Cambium et le Liber.* *Par* M. Mirbel.

Mons. Mirbel, an eminent physiological botanist, had long insisted that the *liber* changed sometimes into wood. Messrs. Dupetit, Thouars, and Knight opposed this doctrine strenuonsly; and Mons. Mirbel now comes forward, with great candour to acknowledge that he has been mistaken, and that he is now convinced of the impossibility of such a change ever taking place.

Art. VI. *Sur une Propriété des équations générales du mouvement.* *Par* M. Poisson.

We shall not undertake to analyse this mathematical paper, although curious and highly interesting.

Note. The two succeeding articles are taken from English journals.

Art. IX. *Prodrome d'une nouvelle distribution systématique du Règne animal.* *Par* M. de Blainville.

The object of this paper is to lay before the public certain tables, containing a new arrangement in zoology, which the author intends to develope and amplify in future in various separate essays. M. Blainville is a young man of the most promising talents, who has pursued the branch of natural history relative to animals for some years. We expect much from him, and this haste to publish the *sketch* of his system has made us suspect that the author has reason to fear what the French call *supercherie*, on the part of some great man engaged in similar studies.

AUGUST.

Art. I. *Continuation of the Prodromus of Blainville's System of Zoology.*

Art. II. *Comparaison du Sucre et de la Gomme arabique dans leur action sur la lumière polarisée.* *Par* Mons. Biot.

It would appear from this Memoir that the experiments made

on the polarisation of light, by means of different substances, of which we have had so many on this and the other side of the water, are likely to bring with them some useful results to the chemist, and above all to the analytical chemist. Mons. Biot has ascertained, that substances similarly constituted exert a sensible and a *similar* action on polarized light. Thus, in a solution of common sugar, and in one of beet root sugar, this action has an equal intensity; a circumstance which, according to the author, confirms the identity of these two substances; while the action is less intense on sugar of milk, its composition being also sensibly different from that of the two former.

Art. III. *Obervations sur le Tarchonanthus camphoratus. Par* M. H. Cassini.

The author of this paper endeavours to rectify the mistakes committed by almost all the botanists with regard to this plant. He concludes, from all its characters, that the Tarchonanthus belongs indubitably to the family of the Synantheræ, and to the natural tribe of the Vernoniæ, of his own formation.

Art. IV. *Note. Sur les gaz intestinaux de l'homme sain. Par* M. Majendie.

See our account of the Proceedings of the Institute.

Art. V. *Mémoire sur les Combinaisons du phosphore avec l'oxygène. Par* M. Dulong.

See our account of this paper under the head "*Annales de Chimie.*"

Art. VI. *Démonstration d'un théoréme curieux sur les nombres. Par.* M. Cauchy.

On reading Mr. Farey's paper on a curious property of the common fractions, inserted in the Philosophical Magazine for May last, M. Cauchy discovered that the said property is nothing more than a simple corollary of a remarkable theorem, which he establishes as follows:

Theorem. If after having arranged in their progressive order the irreducible fractions, the denominator of which does not

exceed a whole given number, we take at pleasure from amongst the series just formed, two consecutive fractions, their denominator will be first between them, and their difference will be a new fraction whose numerator is unity. M. Cauchy gives the demonstration of this theorem.

Art. VII. *Mémoire sur le Gomme d'olivier. Par* J. Pelletier.

This gentleman has obtained from the gum of the olive tree two distinct substances, namely, a crystallized substance which he proposes to call *Olivine*, and a red matter. 100 parts of the gum treated with alcohol, gave

Olivine . .	66
Red Matter .	18
Ligneous residue	8
	92
Loss. . .	8

Mons. Pelletier next enumerates the various properties of these two substances; and the Memoir concludes with observing, that M. Paoli had previously examined the same gum, and succeeded in separating the olivine, but that he had not ascertained its properties.

Journals published in Switzerland.

Bibliothèque Universelle des Sciences et des Arts, January, February, March, April, May.

This new series of the *Bibliothèque Britannique* appeared late in the year, when the above five numbers were ushered into the world, with unexampled rapidity. This circumstance, by affording a large field, prevents our entering upon it at present. We shall therefore defer the analysis till our next Number, and conclude this article with an account of a new Italian Journal.

Analysis of Scientific Journals published in Italy.

I. *Biblioteca Italiana; or a Journal of Science and the Arts. By a Society of Literati.* First year; Jan. Feb. and March, 1816.—*Milan.*

This journal is under the immediate protection of government, and was undertaken to supply the total deficiency of scientific periodical publications, caused either by the cessation or the abolition of those existing under the late government of the kingdom of Italy. The prospectus, which reached this country about nine months ago, detailed the plan of this new journal, in itself vast, and comprehending almost every branch of knowledge. It is the intention of the editors, however, to confine themselves to subjects that have been treated by Italian authors, as well as to Italian discoveries and productions, and to Italian works. They will occasionally notice the labours of foreigners, particularly when connected with their own country; and give from time to time a sketch of the progress of intellectual knowledge in Italy. Works of literature as well as those of science and the arts, will be reviewed. There will appear a number of from eight to ten sheets, 8vo. every month. A director and three assistants, whose collective names are advantageously known to the scientific world, have been entrusted with the care of it. The three assistants are Vincenzo Monti, Scipione Breislak, and Pietro Giordani; Giuseppe Acerbi is the director.

Some circumstances connected with the recent political affairs of that country, have impeded the publication of the first number as originally intended in January. It appeared only in April.

We were glad to find, in times like these, and in a country like Italy, such as it is at present, the following passage in the preface of this journal.

" Every Sovereign sees at last how important and necessary
" it is, for their own glory and the public welfare, that errors
" should be every where extirpated, sound doctrines taught,

"and the knowledge of truth strenuously and generally pro-"moted."

Part 1st. Literature—contains five articles.

Part 2d. Sciences and Mechanic Arts.

1. *Retrospective view of what has been done by the Italians in the natural sciences since the year* 1800.

We intend giving a translation of this interesting paper when concluded.

2. *Subappennine Conchiology*. By G. Brocchi, 2 vols.

A review of this valuable work has been given in a recent number by a cotemporary journal. We must in particular recommend to the attention of naturalists the historical part of this book, in which the author enumerates chronologically the different Italian authors who have written on fossil conchiology, and by which it will be found that great progress had been made in that branch of geology by the Italians, at a time when the study of it was still in its infancy in the other countries of Europe.

3. *Biblioteca dell' Agricoltore*, tom. XI. By F. Gallizioli.

4. *Catechismo Agrario; per uso dei contadini*, &c. 218 pag.

The editors reproach Dr. Gallizioli of having included in the first six volumes the mere translations of foreign memoirs on agriculture, and are of opinion that the Italians need not look to other nations for instruction in the various branches of that science. They express their satisfaction of the present volume, which is of quite a different character.

The *Agrarian Catechism* is highly praised, it is intended for the meanest capacity, and is one of those very scarce works, without pretensions, and treating a science of so much utility in an elementary manner, which are calculated to instruct by plain, just, and short precepts, even the most ignorant on the subject.

5. *History and Description of a New Plant called Littæa*, which has flowered for the first time in Europe, in the year 1815, in the garden of the Duke of Litta.

We have translated and given in another part of this Num-

ber, this highly interesting paper. It will serve to correct the errors into which all the botanists of Europe have fallen, in regard to a plant which has hitherto been referred to various genera, from the inability of examining its fructification.

This number is followed by an Appendix divided into two parts; one of which contains a full account of the premiums offered in several branches of science and the arts, by foreign academies, together with a bibliographic list of foreign works; while the other gives a similar account in regard to Italy. On the whole, we have derived considerable gratification from the perusal of a periodical work which promises to reflect honour and to do much good to the country in which it is published.

Note.—Since writing the above, we have seen the two succeeding numbers for February and March, both containing some interesting articles. But we have already extended ourselves too far on this subject to undertake their analysis at present.

Proceedings of the Academy of Sciences of the Royal Institute of France, from the 5th of August to the 16th of September.

5th of August 1816. The secretary Delambre, after reading the minutes of the preceding Sitting, and the titles of several works and journals presented to the class, laid the correspondence on the table. A letter from the Minister of the Interior was read, accompanying a number of silver medals struck in commemoration of the marriage between the Duke de Berry and the daughter of the King of Naples, to be distributed to each member of the Academy. A Mons. Hautbois sent a MS memoir entitled "*sur l'ame dans l'état de veille et de sommeil,*" and craved the judgment of the class; no commission was named to make a report upon it, but a question arose whether the subject of the memoir could be considered as metaphysical or physiological; when a gentleman present observed "*que où il étoit question de l'âme, il ne pouvait y avoir*

de physiologie." On presenting the last number of the *Journal de Pharmacie*, and the *Bibliothèque medicale*, the titles of all the memoirs contained in them were read, this being the practice of the class. Mons. Moreau de Jonnés, Aid-de-camp to General Carra St. Cyr, presented the three following works:

1. Observations sur les Géophages des Antilles,
2. Essai sur l'Hygiène militaire des Antilles,
3. Monographie des Trinocephales des Antilles.

A letter was read from Mons. Perraud, the translator of Euclid's works, sending the translation of the works of Appolodius and of his commentators. Messrs. Prony, Cauchy, and Legendre were named to examine and make a report upon it to the class.

Mons. de Beauvois presented to the Academy several specimens of germinated beans, affected by a particular disease, the consequence of the unusual quantity of rain fallen this season. It consists in the growth of a species of mushroom implanted in several parts of the stem; and soon destroys the vitality of the plant. M. de Beauvois adopted the plan proposed in such cases, namely, that of cutting off the diseased parts; but although this treatment succeeded in saving the sound part, it of course diminished considerably the abundance of the crop. He thinks that by planting the beans further from each other, than is generally done, and thus allowing a greater circulation of air, the disease might be prevented.

A gentleman was admitted to read a letter on a peculiar manufacture of hats, in which he proposes to employ the fur of the common otter. He produced two specimens, and pretended that the new hat is as fine in appearance and to the touch as what was formerly called castor hat, while its price will not be above two-thirds of the hat now generally sold.

Mons. Cuvier read a memoir of Mons. Moreau de Jonnés, Member of the Legion of Honour, Aid-de-camp to General Carra St. Cyr, Governor of Guiana, on a species of serpents found in great abundance in two of the Antilles only, namely Martinique and St. Lucie, and by the inhabitants called Grande Vipere Fer de Lance, on account of the particular conforma-

tion of its tongue. This reptile, the scourge and dread of the population of those islands, belongs to the first genus of serpents in the classification of Lacepede, the particular character of which consists in several large scales on the inferior surface of the body, and in two ranges of smaller ones under the tail. Opper has lately denominated this class of serpents, *Trigonocephali*, from the specific conformation of the head. The colour affected by a great number of this kind of reptile, suggested the common appellation of yellow serpent, by which it is sometimes known in those colonies. It is of a yellowish red, not unlike that of the dry leaves of plants. The length and cylindrical form of the *Vipere fer de lance* is not unlike that of all other reptiles of the same kind; but the particular form of its head is sufficiently characteristic to distinguish it from all others. It is flat—distinct and triangular from the lateral projections of the jaws at their articulation. The *museau* is flattened on its superior portion—cut square, and terminated by a vertical quadrilateral scale covering the anterior part of the upper jaw, and bisected in the centre at its inferior extremity, so as to form a passage for the tongue, which is sometimes darted through it, without the mouth being open for that purpose. The author pretended to have observed four nostrils, an assertion which the secretary objected to as incorrect. The eyes are large, placed near each other, and analogous in their construction and appearance to those of the birds of night. The mouth is singularly large, being *laterally* three quarters the length of the head, and capable of being opened so as to form an angle of 85, thus giving the reptile the faculty of seizing a prey of very large dimensions. It has a narrow slender tongue, retractile and concealed, at its basis, within a membranaceous sheath, and terminated by two blackish filaments, which the reptile seems to use as feelers rather than as arms of defence. The superior jaw has 15 small white teeth, sharp, slender, and hooked, the inferior from 8 to 10. These serve merely for the purpose of seizing and holding fast the prey, but not to masticate: since the serpent swallows its prey entire. There are on each side

of the upper jaw certain moveable osseous bodies, like teeth white, large about their middle, sharp at their point, semi-transparent and hollow, through which the poison collected in a vesicle situated at their basis, is ejected when the serpent is in the act of biting. These moveable teeth, implanted in a stout muscle, are strongly erected whenever the reptile seizes the prey, and fall subsequently into an horizontal position. The most extraordinary circumstance connected with this animal, which from the fertility of its multiplication, has become the terror and scourge of those islands, is the power it possesses of climbing up high trees, to coil itself up in a rising spiral of four circles, and then to leap to a considerable distance, plunging suddenly on its victim. At other times it erects itself perpendicularly on its tail, reaching the height of six feet or more, and in this position will stand a long while, agitating fiercely its triangular head and darting its sharp tongue in various directions. It appears, however, from repeated experiments and observations, that nature has not left this fierce animal to bask in all the plenitude of undisturbed power; but placed by its side, in nearly equal abundance, another of the genus Boha, perfectly innocuous to man, but terrible in its anger against the *Vipere fer de lance*, which it will often seek, combat, and generally subdue and destroy. The fecundity of the Grande Vipere is really astonishing. The author has sometimes found from 60 to 70 young ones, which from their very birth appeared fierce, alert, and always on the offensive. The bite of these reptiles, when consisting in simple punctures made by the poisonous moveable teeth, are generally considered as fatal; but not so when accompanied by laceration. There are persons who in such cases will undertake to accomplish a cure, not however without many superstitious ceremonies, which on weak and half-educated people have the effect of materially assisting the alexipharmic action of *volatile alkali*, of the *Euphorbi pilulifera*, and various other applications, particularly the moxa. The memoir, which is a long one, and was not concluded, gives many other curious details on this extraordinary reptile, hitherto inaccurately

described, and is replete with interest and important facts.

The Academy resolved themselves into a secret Committee for the dispatch of private business. Adjourned.

12th of August 1816. The Academy proceeded to the election of a new *Academicien libre.* The candidates were Mons. Coquebert de Maubray, Mons. le Marquis de Drée, Mons. Petit Thouars, Mons. Missiaisy, Mons. Deaconville, Mr. Allan. On the scrutiny being taken, Mons. Coquebert de Maubray appeared to have the greater number of votes, being 38 out of 50.

19th of August, 1816. The minutes of the preceding Monday were read and approved. A work was presented on the principles of life insurance. Mons. Majendie was admitted to read a memoir—on the principle of Nutrition, or as he calls it, "sur le Mouvement nutritif." On considering this important question in physiology, the author was naturally led to inquire what could produce the great quantity of azote present in animals; whether it be derived from the food taken by the animal, or rather the production of nutrition itself. In order to throw some light on this part of his investigation, the author devised several experiments, some of which he detailed to the Academy. The first of these was made on a small dog, fat, and healthy. Mons. Majendie, anxious to ascertain whether the azote was derived from the food, selected such substances as are known to possess none, to feed the animal with; for this purpose, after having kept the dog fasting for some time, he gave him sugar and distilled water—the dog became thin and weakly in about three weeks; at this time, also, an ulceration appeared on the cornea of one of the eyes; and went on that of the other. The humours of the eyes then began to issue from the opening till both became quite dry. The animal died on the 32d day of the experiment. On examination it was found that the urine was strongly alkaline instead of being acid as usual, and contained no uric acid; that in the excrements there was no azote whatever, though they generally present a great quantity; and finally, that there was a total absence of all fatty substance. The second experiment was made on

another dog in similar circumstances; and the results were also similar to the former. The ulceration of the cornea and consequent loss of sight in this instance, took place in 27 days, and the dog died pretty nearly at the same time. A third and a fourth experiment offered the same results and deductions. Gum, as possessing no azote, was next employed, and the experiments were followed by the same effects, except the ulceration of the cornea. Butter served for a third set of experiments, which produced the same results, except that the ulceration of the cornea was in this case limited to one eye only. On examination after death, the same total absence of uric acid and of azote was ascertained. M. Majendie, therefore, entertains strong doubts respecting the hitherto supposed nutritive qualities of sugar, butter, &c.* He also supposes from the absence of the uric acid, which he ascribes to the absence of azote, that a method might, perhaps, be devised of providing against the formation, or at least, the enlargement of urinary calculi by abstaining from every kind of food or beverage containing azote. The author has already a number of patients whom he treats by this method, and will soon communicate the results to the public. The president named Messrs. Hallé and Thenard to make a report to the class on the principles advanced in this memoir.

Mons. Paulino read a paper on some experiments on distinct sight, one of which goes to prove, or is intended to prove, that the hitherto received opinion that the dilatation and contraction of the pupil, serves to accommodate the sight to the distance of the object, is incorrect. A familiar experiment is mentioned to shew the truth of this assertion. If a common pin be placed close to the pupil, it is at first not perceived at all, and the next

* This seems in contradiction with facts. It is well known in England that more than once, persons had been found at sea, who for several days after shipwreck had subsisted on nothing but the sugar of the cargo. A fact of this kind occurred three years ago in the West Indies. Besides, how many young babes who are from some cause or other, precluded from sucking, are brought up with sugar and water. Every other kind of food being found to disagree with the system.

moment its shadow only is distinguished, but if the pin be gradually removed to a certain distance, the eye will perceive it, without, however, any alteration in the adjustment of the pupil. Messrs. Hauy, Hallé, and Biot, were named commissaries for a report on this memoir.

Mons. Sedillot, a physician, and secretary to the Medical Society of Paris, began reading a long memoir on the ruptures of muscles. He gave several examples in which muscles had been ruptured, and the disease had been considered and treated as quite of a different nature. Adjourned.

August the 26th, 1816. Mons. Laplace presented a supplement to his Theory of Probabilities. Mons. Legendre, a work entitled, "*Exercices de Calcul Integral.*" Mons. Beauvois, the 14th and 15th livraison of his Flora. Baron Humboldt, another livraison of his *Species Plantarum.* Several journals and pamphlets were presented, the titles of which were read.

Mons. Thenard read a report on some experiments made by Messrs Majendie and Chevreul, on the intestinal gases. The authors were led to their experiments by a memoir written in 1789, by Mons. Juvine of Geneva, in which he detailed the result of his experiments made on the intestinal gases of man in a state of health. Mons. Juvine found in them oxygene gas, carbonic acid gas, azote, and sulphuretted hydrogen gas. He also ascertained, that the proportion of carbonic acid gas was greater in the stomach than in the small intestines, and in these greater than in the large intestine. Mons. Majendie, having an opportunity of examining the bodies of four persons who had been executed, proceeded to the investigation of the subject of his memoir in company with Chevreul. The author took care to keep separate and to prevent all mixture of the gases collected in the three above divisions of the intestinal canal. The results of his analysis were, that the stomach contained oxygen gas, carbonic acid gas, pure hydrogen, and azote. In the duodenum and jejunum the same gases except the oxygene. In the large intestines carbonic acid gas, azote, carburetted hydrogen, and sulphuretted hydrogen. The proportions of these gases relative to each other varied in each of the individuals examined.

Mons. H. Cassini read a note on a new family of plants. He proposes to establish it under the name of *Boopideæ*, which should be placed between the *Synantheræ* and the *Dypsaceæ*. To this new family he refers the genus *Calycera* of Cavanilles, and the genera *Boopis* and *Acicarpha* of M. de Jussieu. These three genera have hitherto been included by botanists, in the family of the *Synantheræ*. The most remarkable characters of the *Boopideæ* are, 1st, each tube of the corolla is marked by three simple nerves meeting together at the summit, one of which is central, and the two other submarginal; 2d, the filaments of the stamina are united, not only to the tube of the corolla, but also to the basis of the limb, while the five antheræ which are without the prolongation of the apex, are united by the edges in their inferior portions only, the superior parts being distinct, and separated from each other; 3d, the style is undivided, smooth, and terminated at the summit by a simple stigma, scarcely observable. 4th, the cavity of the fruit is filled by a seed attached to the summit, by a very small funis which is inserted near the point of the seed, The seed consists of a membranaceous coat, and a thick, fleshy albumen, the axis of which is occupied by a cylindrical, straight germ or embryo. The author farther observes, that the Boopideæ differ principally from the *Synantheræ*, by the form of the anthers, which are without the prolongation of the apex, by the conformation of the style and stigma, and by the seed which is suspended from the summit of the cavity of the ovarium, and which consists in part of a very thick fleshy albumen, that they also differ from the *Dypsaceæ*, amongst other characters, by the submarginal nervuses of the corolla, and by the partial union of the anthers; and lastly, that the Boopideæ approach to the other two families mentioned by the nervuses of the corolla, which presents both the central and submarginal lines, as well as by the arrangement of the anthers which are united in the inferior part, but distinct and even at some distance from each other in the superior part. M. Cassini believes that this little group will form a very natural and satisfactory transition from the family of the Synanthereæ to that of the Dypsaceæ, and confirm

the connexion of the systematic lines in the natural arrangement. Mess. Desfontaines and Mirbel were named commissaries for a report.

Mons. Hachette read a memoir divided into two sections, the second being subdivided into four paragraphs, on the phenomena which fluids present when issuing out of thin vessels, with small apertures, of various geometric configurations. This memoir is a continuation of one read by the same author a year ago.

Mons Chevreul detailed to the Academy the progress he had made in his researches on fat substances, on which he has now written eight memoirs. In one of these he proposes a nomenclature for the new substances and combinations he has discovered in the pursuit of his investigations. Adjourned.

September 2d, 1816. Mons. Lamarck presented his work on the animals without vertebræ, in three volumes, the last published in August 1816. Several books were also presented from Dr. Brewster, Professor Pond, the Astronomic Society of Glasgow, &c. Mons. Girard read a report on the agrarian measures of the Egyptians, and the relation they bear to the modern decimal system of mensuration. The duodecimal division was introduced into Egypt by the Greeks; and before that epoch, their agrarian measure was a *canne* or a measure of seven cubits, each subdivided into 7 palms. The *cubit* was subdivided into 7 palms from the manner of marking the cubits on the cane. The person charged to divide the latter, placed his elbow on a table or other support, the fore arm being extended and vertical. The cane was applied to it, and at the point where it corresponded to the tip of the middle finger, it was grasped with the right hand, and brought down to the elbow again, which was then applied to the lateral and superior part of the grasping hand, in order to measure the second cubit, and so on in progression. Thus the cubit being naturally 6 palms, had 7 on the Egyptian measure from their mode of marking it.

Two letters were read from the Minister of the Interior. The first informing the class of the king's approbation of

Mons. de Maubray's nomination, the other acquainting them of the death of one of the corresponding members of the academy. This person is Mons. Bernard, who some time ago observed the satellites of Saturn, before neglected by astronomers, and published subsequently a work on hydraulics, and some memoirs on agrarian subjects.

Mons. Pelletan read a report on a proposition made by a Mons. Delpech, a surgeon, in which he had offered a premium of 1,000 francs, to the person who should cure a fracture of the neck of the femur without any derangement in its form, length, or figure. The committee was of opinion that the proposition was chimerical, and to be rejected.

Mons Latreille read a report on a memoir of Mons. Beudant, on the possibility of bringing up salt water moluscæ in fresh water, and vice versa (see our extract of this memoir in the Annales de Chimie). The committee was of opinion that the subject and the manner in which it is treated are interesting, and as such, the memoir ought to be consigned in the collection of the memoirs of the Savans Etrangers.

Mons. Beauvois presented specimens of a parasitic plant growing on another parasitic plant found on the flax shrub. The author thought that this was the first instance that had ever been noticed of such an occurrence, till Mr. Brown, who is now in Paris, informed him that he had seen it twice before.

M. Poisson read a paper on certain equations of movement; being a supplement to a former memoir on the same subject, in which the author has given several formulæ for resolving the greatest part of the problems proposed in the present paper. M. Poisson applies his theory to certain movements of the planets.

Mons. Biot read a memoir on, and described the construction of a new instrument, devised to trace in a distinct and always exact manner, all the primitive and compound colours, so as to be able to find and ascertain the exact intensity of a given colour, by comparing it with a similar one produced by the instrument. Hence the name he has given it of *Colorigrade*. The instrument was exhibited on a large and a small scale, the latter being not unlike a pocket telescope in its exterior form

and size. This instrument may, by a simple modification, be changed into a *cyonometer.*

Sitting of the 9th of September, 1816. A model of an apparatus intended to do away with the necessity of having a mass of water in the locks of navigable canals for the passage of boats was exhibited. It consists of two parts ; one being a kind of lever, the other being formed of two parallel wheels readily put in motion. The inventor calls it *Hydrobascule.* A memoir, but little explanatory of his machine, was read by the author, and commissioners appointed to examine it.

Several works were presented, and some letters read.

Mons. Deschamps read a report on Mons. Boyer's *Traité des Maladies chirurgicales.*

The 10th and 11th livraison of the *Champignons* by Poulett, were announced to the class.

Mons. Dumeril made a report on the memoir of Mons. Moreau de Jonnés, with a satisfactory conclusion (see our report in the beginning of this part of the Journal).

Mons. Dulong read a memoir on the combinations of azote and oxygene, in which he states that the results he obtained from actual experiments, differ from those of Gay-Lussac chiefly inferred from analogies. We thought we heard him state, among many other things, that the combinations known under the name of nitrous acid gas is liquid and not gaseous at the common temperature ; and that it owes its elastic state to the presence of some foreign gaseous substance. He exhibited the liquid in question similar to that distilled from nitrate of lead, but obtained by a mixture of dry oxygene gas and nitrous gas in a tube brought to a certain temperature. We were, however, too far distant to be sure that we heard him rightly.

Mons. Beauvois read a memoir on the parasitic plant mentioned, and of which he had presented specimens at the last meeting. After some other unimportant business, the Academy adjourned.

Sitting of the 16th September. The Secretary, after reading the minutes of the preceding meeting, presented several works, amongst which were the numbers of the Journal de Pharmacie

for August. That of the Bibliothèque Universelle for June, and the second volume of Mons. Fressinet on the discoveries made in the voyage to the Terres Australes. Mons. Delambre read a report on the memoir by Cadell extracted from the Philosophical Transactions of Edinburgh on the Art of Dialling.

M. Lavenu was admitted to read a memoir on musket balls lodged in the cavity of the thorax. Not concluded. Adjourned.

Art. XXI. *Discourse of the Hon.* T. S. Raffles. *Account of the Sunda Islands and Japan.*

Since the cession of Java and its dependencies to the British government, the facilities of obtaining information respecting this highly interesting portion of the eastern hemisphere have considerably increased. The Batavian Society of Arts and Sciences was the first institution of a literary nature established by Europeans in the East. Seven volumes of their Transactions had been published previous to the conquest of Java by the British, an eighth has been since published, and the ninth, we understand, is now in the press. The first seven volumes are exclusively in Dutch, the eight and ninth partly in English and partly in Dutch. For some time previously to the conquest, the Society had become nearly inactive. Although we have not yet had an opportunity of inspecting the volumes already published of these transactions, we are enabled from the very interesting Discourse delivered to the Society by Mr. Raffles, on the 10th of September, 1815, to lay before our readers some details respecting this country. and also some observations on Japan, by Dr. Ainslie.

The island of Banca has only during the late periods of the European establishments attracted notice. Dr. Horsefield has, however, under the instructions of government, employed himself in making a collection of information respecting the position, geological structure, and natural productions of that important island. The discovery of the tin-mines

about the twelfth year of the last century, first gave it celebrity; little had been done, however, in the way of scientific research till the labours of Dr. Horsefield. The Dutch government, it is true, set on foot some enquiries at different periods; but their views were confined to commercial objects; and little was known of the country, beyond the extent of the produce in tin, which it could annually export.

With regard to the mineralogical constitution of Banca, Dr. Horsefield remarks, that the direction of the island being from north-west to south-east, it follows, not only the direction of Sumatra and the Malayan peninsula, but also the great chain of Asiatic mountains, one of the many branches of which terminates in Ceylon; while another, traversing Arahan, Pegu, the Malayan peninsula, and probably Sumatra, sends off an inferior range through Banca and Billiton, where it may be considered to disappear.

The elevated parts of Banca are observed to have the same constitution as the great continental chain, being composed principally of granite; after which occurs a species of rock, termed by Dr. Horsefield, *red iron stone*, extensively distributed in situations of secondary elevation, in single rocks, or in veins covering large tracts of country. Tracts composed of this rock are bounded by alluvial districts, which are again subdivided into undulating hills, gradually rising on others of apparently prior formation, and such as are low and level, of recent origin, and bordering on the mouths of the rivers. Those districts which occurring in juxta-position with the primitive portions, fill that space between these latter and the veins of red iron stone, or, again, between those and alluvial parts, are stratified; and the strata uniformly horizontally arranged.

It is through these horizontal strata that the tin-ore is disseminated; and, as far as has hitherto been remarked, is either immediately under the surfaae, or at no great distance from it.

The process of mining in Banca is remarkable for its simplicity. It consists in an excavation, made by digging perpen-

dicularly to the beds of the ore, and a proper application of the water to facilitate the labours of the miners, and the washing of the ore. A favourable spot being selected, the pit is sketched out, a canal conducted from the nearest rivulet, and then the miners excavate the soil until they arrive at the stratum containing the ore, which is next deposited in heaps near the water, so as to be placed conveniently for washing: the aqueduct is lined with the bark of large trees, and, a stronger current being produced by the admission of more water, the heaps are thrown in, and agitated by the workman; the particles of the ore subsiding through their gravity, and those of common earth being carried away by the current.

With respect to Borneo, although no regular scientific enquiries have taken place relating to this island, considerable information has been obtained relating to its productions and the increase of the natives; some notices also of inscriptions in unknown characters, and ruins of temples in different parts of the country, have been obtained, though as yet too vague to be relied on; but when it is considered that this island, embanking, as it were, the navigable pathway between the eastern and western hemispheres, and lying contiguous to the most populous regions of the globe (China and Japan), there can be little doubt but at one period it must have risen far above its present state of degradation and neglect. That Borneo was visited, many centuries ago, by the Chinese and Japanese, is well established; but whether it was ever more extensively colonized by either of those nations than it is at present from China, must be left to future enquiry.

The Discourse contains some curious information concerning the inhabitants of the island of Celebes, and its form of government.

As to Java, no country in the eastern hemisphere possesses more extensive traces of antiquity, foreign intercourse, and national greatness, than are exhibited in the numerous monuments of a former worship, in the ruins of dilapidated cities, and in the character, the institutions, the language, and the literature of its people.

In order to explain the high fertility of the soil of Java, in comparison with that of the Maylayan peninsula, it will be observed that from the result of every investigation yet made, the geological constitution of that island appears to be exclusively volcanic, without any admixture whatever of the primitive or secondary mountains of the Asiatic continent; while on the contrary, Sumatra and Banca, as before noticed, appear to be a continuation and termination of the immense chain of mountains which pervades great part of Asia, and runs off finally in a direction north-west to south-east. Java deviates from the direction of Sumatra and the peninsula of Malacca in striking off directly west and east. In this direction it is followed by the larger of the adjacent islands of Bali, Lombok, Simbawa, Endi, and Timor; and by many smaller, which contribute to form an extensive series. This direction, as well as the consititution of all the islands enumerated, indicates the existence of an extensive volcanic chasm in this part of the globe, running for many degrees, almost parallel with the equator. The consequences of Java's being exclusively volcanic are, that while Sumatra abounds in metals, Java, generally speaking, is destitute of them; that while in Sumatra there are many extensive tracts, sterile, and unfavourable to vegetation, Java, with few exceptions, is covered with a soil in the highest degree fertile, and productive of every species of vegetation.

The investigation of the splendid remains of the temples of Java, her cities, her language, and her literature, form a subject as interesting to the philosopher and the antiquary, as the varieties of her natural productions, render the country an object of curiosity to the naturalist. Captain Baker, who has been actively engaged in inquiries respecting the monuments of antiquity in this island (the most splendid of which are to be found at Prambanan, Boro Bodo, and Singa Sari), observes, "Nothing can exceed the air of melancholy, desolation, and ruin, which this spot presents; and the feelings of every visitor must be forcibly in unison with the scene of surrounding devastation, when he reflects upon the origin of this once venerated, hallowed spot; the seat and proof of the perfection

of arts now no longer in existence in Java; the type and emblem of a religion no longer acknowledged, and scarcely known among them by name: when he reflects upon that boundless profusion of active, unwearied, skill and patience, the noble spirit of generous emulation, the patronage and encouragement which the arts and sciences must have received, and the inexhaustable wealth and resources which the Javanese of those times must have possessed!" and in describing the Chandi Sewo, or Thousand Temples, which forms a principal part of these ruins,—"Never," he observes, "have I met with such stupendous, laborious, and finished specimens of human labour, and of the polished, refined taste of ages long since forgot, and crowded together in so small a compass, as characterise and are manifested in this little spot; and though I doubt not there are some remains of antiquity in other parts of the globe more worthy the eye of the traveller, or the pencil of the artist, yet Chandi Sewo must ever rank with the foremost in the attractions of curiosity, or of antiquarian research."

The perfection of the language of Java, is one of many proofs that at a former period it was far advanced in civilization. Two languages may be considered as prevalent in the island: the Sunda in the west, and the Javanese, which is the language of the eastern part; the first is a simple dialect accommodated to the purposes of the mountaineers who speak it, and perhaps differs from the Javanese not so much in its construction as in the proportion of original and of Malayan words which it contains.

In the Javanese, or language of the eastern division of the island, and also of the lower parts of Bantam and Cheribon, the natural or vernacular language, in like manner contains a considerable number of words in common with the Malayan, and the general principles of construction are found to have a striking accordance. We thus find strong proofs in support of one common origin of the prevailing languages of the Archipelago, notwithstanding that a large portion of the Malayan words now used in Java may be ascertained to have been received at a comparatively recent date; and in the course

of long and continued intercourse with the neighbouring countries.

The Javanese language, properly so called, is distinguishep by a division between what may be considered as the vernacular language of the country, used by the common people among themselves, and which is adopted when addressing an inferior, and what may be considered as a court language, adopted by all ieferiors when addressing a superior. The same construction, as well as the idiom, is pretty generally preserved in both the languages; the latter, however, consists of a more extensive class of foreign words.

In the contemplation of the various nations and tribes which inhabit the southern peninsula of India, and the many islands composing that portion of the globe which is comprehended within Polynesia and Austral Asia, the attention is forcibly arrested by the striking uniformity in habits and language which prevails throughout, and which induces the inference either of one common origin, or of early and very general intercourse.

Such customs as the singular practice of filing the teeth, and dying them black, noticed by the authors who have written on Pegu, Siam, Camboja, and Tonquin, and prevailing generally throughout the whole Malayan archipelago; the practice of distending the perforated lobe of the ear to an enormous size, noticed in like manner to exist in the same parts of the peninsula, and prevailing throughout the archipelago, in a greater or less degree in proportion with the extension of Islamism; the practice of tattooing the body, noticed among the Burmans and people of Laos, common to many tribes in Borneo, and particularly distinguished in some of the islands in the Pacific Ocean, betray a common original; and if it is recollected that this custom, as well as that of plucking the beard, was noticed in South America, the question may arise, in what course or direction the tide of population has flowed? In a recent publication, an idea has been started, in reference to the similatity of the languages, that the population of the Philippines and of the islands in the South Sea originally emigrated from America. To trace the

sources whence this colonization and consequent civilization flowed, and the periods at which it was introduced into different states, is a subject new to the historian, and not uninteresting to the philosopher.

Dr. Horsefield is at present engaged in exploring the districts lying to the east and south of Suracata, with the view of completing materials for the Natural History of Java: his *Flora Javana* is already far advanced. We understand that Mr. Raffles has it in contemplation, at some future period, to publish an Historical Account of Java from native authorities, with an Essay on the Language and Literature of the Eastern Islands: and there can be no doubt, but that such a work will be a very valuable addition to our information respecting the East.

The Discourse also contains some very curious remarks regarding Japan: and this we consider to be the most interesting portion of the work. This information was obtained from the verbal communications of Dr. Ainslie, who resided in Japan four months. Nothing can be more satisfactory than the following testimony in favour of the accuracy and impartiality of Kæmpfer. "I am assured," observes Dr. Ainslie, "that there is not a misrepresentation throughout his book; he was a man of minute accuracy and felicity of talent, who saw every thing as it was, and not through the mist or medium of any preconception. The Japanese observe of him, that he is, in his History, 'the very apostle of their faith,' from whose works alone they know their own country. Their first enquiry was for a copy of Kæmpfer; and, endeavouring to evince the estimation in which this author was held by them, their observation literally was, that 'he had drawn out their heart from them, and laid it palpitating before us, with all the movements of their government, and the actions of their men!'"

For a people who have had very few, if any external aids, the Javanese cannot but rank high in the scale of civilization. The traits of a vigoroos mind are displayed in their proficiency in the sciences, and particularly in metaphysics and judicial astrology. The arts they practise speak for themselves, and are deservedly acknowledged to be in a much higher degree

of perfection than among the Chinese, with whom they are by Europeans so frequently confounded; the latter have been stationary at least as long as we have known them, while the slightest impulse seems sufficient to give a determination to the Japanese character, which would progressively improve until it attained the same height of civilization with the European. Nothing indeed is so offensive to the feelings of a Japanese as to be compared in any one respect with the Chinese.

The people are said to have a strong inclination to foreign intercourse, notwithstanding the political institutions to the contrary; and perhaps the energy which characterizes the Japanese character cannot be better elucidated, than by that extraordinary decision which excluded the world from their shores, and confined within their own limits a people who had before served as mercenaries throughout all Polynesia, and traded with all nations—themselves adventurous navigators.

The Japanese, with an apparent coldness, like the stillness of the Spanish character, and derived nearly from the same causes, that system of *espionage*, and that principle of disunion, dictated by the principles of both governments, are represented to be eager for novelty, and warm in their attachments; open to strangers, and abating the restrictions of their political institutions, a people who seem inclined to throw themselves into the hands of any nation of superior intelligence. They have at the same time a great contempt and disregard of every thing below their own standard of morals and habits, as instanced in the case of the Chinese.

This may appear to be contradicted by the mission from Russia in 1814, under Captain Krusenstern; but the circumstances under which that mission was placed, must be considered. From the moment of their arrival they were under the influence of an exclusive factor, who continued to rain upon them every possible ignominy which can be supposed to have flowed from the despotism of Japan, through the medium of an interested and avaricious man, who dreaded competition, or the publication of his secret.

It is an extraordinary fact, that for seven years past, since

the visit of Captain Pellew, notwithstanding the determination of the empire not to enter into foreign commerce, the English language has, in obedience to an edict of the Emperor, been cultivated with considerable success by the younger members of the College of Interpreters, who, indeed, were found eager in their inquiries after English books.

Whilst Dr. Ainslie was at Nanggasaki, a detachment of officers of rank arrived, who had been four years engaged in making a survey of every foot of the empire, and its dependences: not a fourth was then completed: it appeared to be conducted on a scientific principle, and most minute and accurate in its execution.

Art. XXII. *A geological Account of the Lead Mine of Dufton, in Westmoreland. By* T. Allan, *Esq. &c. &c. In a Letter to the Editor.*

Dear Sir,

I do not recollect to have met with any geological description of that small portion of country, in which the lead mine of Dufton occurs. I lately had an opportunity of spending a few hours upon the spot; but was deterred by the extreme intemperance of the weather from making that use of my time I would otherwise have done, glad to take shelter in the mine, in place of examining the rocks which surrounded it. The assemblage of these appeared to me so interesting, that, although my information was chiefly picked up from the miners, who were, in general, intelligent people, I shall venture, through the medium of your Journal, briefly to mention them, with the hopes of inducing some other geologist to undertake the task of minute description.

Dufton is situated near the great road from London to Glasgow, and is, consequently, to be visited with less inconvenience than any other mining district in the north of England. It lies three miles north of Appleby, in Westmoreland, on the

west side of a range of hills, which extends from the borders of Scotland, and includes Cross Fell, and the mining district of Alstone Moor. Alng the western verge of this range, there are several detached and remarkably regular conical hills, the appearance of which had often attracted my attention, when passing along the road between Penrith and Kendal. It is on the west side of one of these, which is called Dufton Pike, and which I should guess to be about 600 feet high, that the village of Dufton is situated; and the hill is so placed, that the ravine in which the mine occurs is entirely concealed from view. From the base of the mountains which surround Ulleswater to that of Dufton Pike, the country is entirely composed of red sand-stone, or covered with alluvial soil. I was therefore surprised to find the Pike itself composed of rocks, belonging to the transition series. Knock Pike and Mutton Pike, the detached conical hills to the north and south of it, I presume are of the same description, as are also some others, which close in upon the range of mountains, forming, as it were, parts of the same groupe.

The ravine in which the mines are wrought, may be about half a mile wide at the entrance, and extends from Dufton Pike about a mile and a half: the ascent to the mine is steep, but such as to be practicable with carts; the rocks on both side are well exposed to view, and present a precipitous front to the west; on the side of the road, which leads along the south declivity, before entering the ravine, I observed slate rock, sufficient to mark the existence of the transition series, and on it rested strata of lime-stone, and what is denominated in the country *Hazle Sill*; which I found to be a thick bed of pale coloured sand-stone.

The vein was originally wrought on the summit of the western front of the precipice; and the lead procured by *hushing*; that is, by bringing a stream of water to run over the plaee where it cropt out. Subsequently a level was constructed, which must have been at a very great expense, seeing it is driven for a great distance through a very solid green-stone; here, as in Scotland, denominated whin. It has, however, been constructed with much judgment, and I have

never seen a mine better aired or more free from water, if I except the salt mines of Cheshire. This bed of green-stone is, perhaps, the largest we are acquainted with: at Dufton it is twenty fathoms thick; and, I was told, in Teesdale it was at least sixty: its extent also is very great. Here it is interposed between two beds of lime-stone, the upper four fathoms, the under only three yards thick; and it is in these two that the lead is wrought. The vein passes through all the three beds; but is prolific in lead only in those of lime-stone: there it widens out into plates, filled with spars and metal; but in the green-stone it is compact and narrow, still, however, producing a small particle of lead now and then, as if to identify the course. Beyond the range of these three beds the workings were not prosecuted, and I could not learn what appearances the vein at these extremities assumed. The nature of the strata both above and below, appeared very unusual; over the four fathom lime-stone a bed of *plate* (very friable shale) occurs, then a Sill of Hazle, with some small seams of coal; beyond this my informant could not speak with certainty; under the lower bed of lime-stone another bed of Hazle, and strata of coarse lime-stone appeared; and these I believe to rest upon the transition rocks.

At the extremity of the north side of the ravine there is a hill, connected at its base with that in which the ravine is. It is singular to observe how abruptly the metalliferous strata are cut off; these jut boldly out, and exhibit their regular horizontal position distinctly to view; while the hill, whose base touches upon that on which they rest, presents a rugged surface, composed of strata set upon edge.

Without being able to give a more detailed description of this district, I believe I have said enough to prove the interest which a more minute investigation of it will afford, which I shall be glad to see given to the public through the medium of your Journal. Your's, &c.

T. ALLAN.

Edinburgh, August 21, 1816.

Art. XXIII. *On the Mode of Ventilating and Warming the Infirmary at Derby. In a Letter to the Editor.*

Sir,

The Derbyshire General Infirmary being celebrated both at home and abroad, for the peculiar conveniency and economy of its arrangements, and for many valuable improvements, by which the objects of such an institution are more successfully accomplished than in any other hitherto established, particularly as it relates to the uniform temperature diffused through the whole house, accompanied by a copious ventilation; a short account of this establishment, and of the means by which it has been accomplished, may not be uninteresting to your readers, especially as this subject has of late become of general interest.

This building is of a cubical form, and consists of three stories. The basement contains the offices, two public warm-baths, a steam engine, and the warming stoves. The middle story the household part; and the upper story is entirely appropriated to the patients. This is divided into two parts for males and females, each consisting of a certain number of wards of different sizes, containing beds, and a large room occupied in the day by the convalescent patients. A certain part of each story is completely insulated from the rest for the reception of fever patients. This part has a separate entrance, with offices and every convenience, so as to preclude the necessity of any communication with the other parts of the house.

The apparatus employed for warming the building was invented by W. Strutt, Esq. of Derby, in the year 1792, and has been extensively used by him for various purposes ever since that period. In adopting it to the above institution, the inventor connected with it a more perfect means of ventilating than had hitherto been adopted, securing at all times a constant change of air in every ward, independent of the casual openings of the doors and windows.

The stove is placed about twenty feet below the patient's

story, and is calculated to warm a large quantity of air, while it is passing through it immediately from the atmosphere. The air derives its heat from an iron vessel about four feet square at the base, and six feet high, the top part being arched, forming a groin. This vessel is placed with the mouth downwards over a fire place, so that the interior surface may be constantly exposed to the flame and radiant heat. The smoke escapes through a narrow opening under the flange of this vessel into a flue on each side, which afterwards unite and pass into a chimney. All this part, as well as the ash-pit and fire-place, are carefully secured against any communication with the exterior parts of the vessel, which is intended to heat the air for warming and ventilating the rooms.

This vessel is formed of wrought iron, rivetted together in the manner of steam-engine boilers, and is called *the cockle.* The room in which the exterior of this vessel is exposed, communicates with a subterraneous passage, about four feet square, and extending to about fifty yards from the building. From this point, a perpendicular shaft arises to about twelve or fifteen feet above the surface of the ground. This opening is terminated by a cowl or turncap, provided with a vane, which has the effect of keeping the entrance for the air always presented to the wind. This entrance insures a current of air towards the stove equal to the velocity of the wind. I will now explain how the current of air is determined to the cockle, on its way to the different rooms to be warmed.

The cockle is surrounded by a brick wall of nine inches, leaving a cavity between the wall and the cockle about nine inches wide. In this wall are left square openings of about two inches, opposite to the iron surface. These holes are distant horizontally a brick in breadth, and perpendicularly a brick in thickness; each of these square holes contain a square tube made of rolled iron, extending the opening to within about half an inch of the side of the cockle. This wall with openings and tubes at similar distances extends to the very crown of the groin, the brick-work being groined of the same shape as the cockle. The number of holes and tubes in the whole surface is about 600.

The lower half of these tubes are for the admission of cold air, which strikes the cockle perpendicularly to the surface. The upper half of the tubes are surrounded by a chamber which contains the hot air, and of course completely insulated from the rest of the room. When the cold air enters the lower portion, it first strikes the hot cockle, and then rises into the upper cavity, from which it cannot escape but through the upper set of tubes into the hot air chamber; but before it enters these tubes it must make various eddies, by which it will be often brought again in contact with the upper part of the cockle. By this means the air is made to carry off the greatest possible quantity of heat; this will also depend upon the velocity of the current, which is as the square root of the height through which the heated air has to ascend, before it is delivered into the rooms.

From the hot air chamber the air is conveyed by a vertical funnel up to the level of the patient's story; from this point it is conveyed by horizontal flues to the different rooms. The area of the section of the perpendicular funnel is about 7 feet, and the average velocity of the air is about five feet per second, at the temperature of 130°, allowing the average temperature of the air in winter to be 40°. This is when the fire of the stove is moderately kept up, and when it would consume from three to four cwt. of coals in twelve hours. This stove, if the fire was kept up night and day, would keep 200,000 cubic feet of space at 60° in the coldest part of the season; the rooms not exceeding ten feet in height. The opening from the flues into the different rooms are provided with registers, to adjust the quantity of air required to produce the limited temperature, which is 60°. The outlet from each room is a common chimney. The whole of these terminate in the roof of the building. The foul air which they bring escapes into the atmosphere through a turn-cap, similar to that through which the air enters, with the exception of the aperture being always presented from the wind, by placing the vane on the same side as the aperture.

In the summer season the air passes through the same flues as in winter, but the foul air escapes at the top of the room

instead of the bottom. The subterraneous passage being about the temperature of the earth, cools the air in summer, and gives to it a certain degree of heat in winter which economises fuel.

Mr. Sylvester of Derby, from whom I have obtained these facts, will very soon publish a particular account of this method of warming and ventilating, with working plates engraved by Mr. Lowry. The same work will embrace many other valuable improvements belonging to the same institution, with their application to similar public buildings, churches, private dwellings, and manufactories.

Art. XXIV. *Proceedings of the Royal Society of London.*

April 25. Sir Everard Home read an Appendix to his Paper on the Effects of Colchicum Autumnale, in which he announces the important fact, that the same effects upon the pulse, stomach, and bowels, are produced by injecting the infusion into the veins, as by throwing it into the stomach; a fact which corroborates his opinion respecting its *modus operandi*, noticed in our former report. The experiments were made upon a dog, and the results of large and small doses were identical with those where the infusion was taken into the stomach.

May 2. A Paper was communicated by Dr. Nixon, upon the beneficial effects of electricity in cases of Aphonia, or loss of articulating power. A French officer at the battle of Dresden was in the act of giving the word of command, when a cannon ball passed by, and stunned him, without producing any wound. He remained long insensible and convulsed, and upon recovery, his hearing was impaired, the sense of taste destroyed, and the power of articulation completely annihilated. He was cured by passing electric shocks through the parts affected.

Dr. Wollaston communicated a Paper on the glazier's diamond. The gems chosen for glass cutting are those which have natural curved faces and curvilinear edges. When a diamond of this form is intended to cut glass, it must be so held that the surface of the glass may be a tangent to the curved edge of the crystal, in which situation a groove is cut, when it is drawn along under gentle pressure, and the parts may then be separated by a gentle force. Dr. Wollaston found that upon giving the surface of a fragment of flint the same shape as that of the cutting diamond, it acquired the same property, but its inferior hardness renders it much less durable.

May 9. A Paper was communicated by W. Chapman, Esq. relating to the formation of Coal Districts. He imagines peat beds to have furnished the original materials of mineral coal, and considers compression as the agent which has indurated and compacted the mass. His conjectures are strengthened by a comparison between the structure of peat bogs and of coal beds

May 16. Dr. Wollaston presented a Letter from Mr. Mornay, describing a mass of iron discovered in Brazil, weighing 14,000lb. This, like other blocks of the same material found elsewhere, contains a portion of nickel, and is magnetic, whence its meteoric origin is inferred. An analysis of a specimen of this iron was annexed, by Dr. Wollaston.

May 23. A Letter from T. A. Knight, Esq. to the President was read, announcing his having observed ice attached to the pebbles at the bottom of a river, while the surface remained unfrozen; a circumstance which he accounts for by supposing the eddies of the current to have brought small particles of ice into the contact of the stones, to which they had adhered He had not observed the same fact in still water.

At the same meeting Sir Everard Home communicated some observations on the formation of fat in the tadpole, a subject to which he alluded in his remarks on Mr. Ireland's Paper on the "*Rana Paradoxa*," published in the first volume of this Journal, (page 57.) Sir Everard describes the changes

which the tadpole of the Surinam frog undergoes, both in external appearance and internal structure, and is thus led to some curious physiological facts; the most remarkable of which is, that the tadpole is provided with a great length of intestine, while, in the frog, this canal is comparatively short. Evidence is then adduced to prove, that in the former case the intestinal canal is concerned in the production of fat; that it is a kind of save-all in respect to the food, from which every nutritious particle is thus abstracted; the growth of the frog being perfected, the same œconomy is not required, and accordingly a different structure is provided. This Paper abounds in curious facts and speculations relating to the production and uses of fat, and to the processes of its formation, and is enriched with many chemical facts respecting the composition of various ova, for which the author is indebted to Mr. Hatchett.

June 13. A letter to the President from T. A. Knight, Esq. described some new experiments on the leaves of plants, tending to shew their influence upon the formation of woody fibre and alburnum, and upon the production of fruit.

Dr. Holland, at the same meeting, communicated an account of the method of manufacturing sulphate of magnesia in the vicinity of Genoa—it is formed by the action of decomposing pyrites on magnesian limestone.

June 20. A letter to the President from Dr. Brewster was read, containing experiments on the refracting powers of the eyes of fishes, and announcing some peculiarities in them in this respect.

June 27. Sir Everard Home communicated some additional observations on the structure of the feet of those animals whose progressive motion is carrried on in opposition to gravity. (See Vol. I. p. 116.) He also notices a peculiarity in certain leaping insects, whose feet are supplied with elastic balls for the purpose of breaking the violence of their fall. Sir Everard conceives that these structures will furnish a new clue to the classifier of the insect tribes.

July 4. Methods of destroying the contagious matter of the plague adhering to letters and parcels, devised by B. A. Gomez,

were communicated to the Society, by John Barrow, Esq. Some other Papers were announced, and the Society adjourned for the long vacation, to meet again on Thursday, Nov. 7.

Art. XXV. *Proceedings of the Royal Society of Edinburgh.*

June 17*th.* Dr. Brewster laid before the Society several notices respecting light. They related chiefly to the phenomena of optical contact; to the inflexion of light; to the colours of thin plates; to the production of nebulous images by doubly refracting crystals, and to the phenomena and law of the distribution of the polarising force in tubes, cylinders, and plates of glass. From the experiments on inflexion, it follows that the deviation which the rays of light experience in passing by the edges of bodies, is not produced by any force inherent in the bodies themselves, but that it is a property of the light itself, and always appears, and has the same character whenever divergent light is interrupted by a shadow, whether the shadow is produced by cork, by platina, by diamond, by a dark groove in a metallic surface, or by a cylinder of flint glass immersed in a mixture of oil of cassia and oil of olives, that has precisely the same refractive power as the glass.

In the notice respecting the law of the distribution of the poralising force in unannealed and bent glass, a method was explained of determining a priori, the distribution of the polarising force in pieces of glass of all shapes; of ascertaining when two opposite structures, and when only one structure would be developed, and of finding the tint which is exhibited in any given part of the glass. It was shewn that the curve which represents the relation between the tints and the distances is a parabola, whether a single or a double structure is developed; that the curves produced by crossing unannealed plates that give the *usual* fringes are hyperbolas; that the curves produced by crossing plates that give the *unusual* fringes are circles when the plates have the same breadths and

the same tints; but that they become ellipses when the tints or the breadths are inequal; that the curves produced by crossing bent plates of glass with unannealed plates are parabolas; and that the central tint is to the external tint, as the distance between the black fringes is to the breadth of the plate, which is always as 10 to 16.02.

July 1*st*. A Paper by the Rev. Dr. Fleming of Flisk, was read, entitled "Observations on the junction of the Fresh-water of Rivers with the Salt-waters of the Sea." Dr. Fleming made a number of experiments on this subject at the beach of Flisk, on the Firth of Tay, with a very simple apparatus, by means of which he could bring up water from any given distance from the surface. The general conclusion deduced from these experiments was, that when the wave of the tide obstructs the motion of a river, and causes it either to become stationary, or to move backwards, the effect is produced by the salt-water presenting to the current of the river an inclined plane, the apex of which separates the layer of fresh water from the bed of the channel, and suspends it buoyant on the surface.

At the same meeting a few specimens of words, manufactured in relief, for the use of James Mitchell, the blind and deaf young man, were exhibited to the Society by Dr. Henry Dewar.

The Meetings of the Society were adjourned till November.

Art. XXVI. *Miscellaneous Intelligence.*

I. *On the Temperature of the Air, the Sea, Animals, &c. within the Tropics.*

Extract of a Letter from John Davy, *M.D. F.R.S. to Sir* Humphry Davy.

Cape Town, May 18, 1816.

"Between England and the Cape I have found the sea-water in different latitudes and longitudes nearly of the same

specific gravity; the greatest difference has not exceeded one or two per cent.

"Thus water taken up in the English channel, into which a considerable quantity of fresh water from rivers is discharged, was of specific gravity 1077, and that under the Line no more than 1087; so that the assertion contained in many chemical works respecting the greatly increased density and saltness of the sea within the tropics, is quite unfounded. Whether there be any difference of composition I shall ascertain at my leisure, on my arrival at Ceylon, by the examination of the numerous specimens of salt-water which I have carefully preserved for analysis.

"The temperature of the atmosphere and of the ocean, was a subject to which I paid, during the whole voyage, much and minute attention, and at every part of the twenty-four hours. All the results I obtained were almost such as might have been anticipated by reasoning on the principles of natural philosophy. For instance, the little difference of temperature at a great distance from land, during the day and night,—not exceeding two degrees. The temperature of the air being greatest exactly at noon, and the temperature of the water at its maximum about two hours after: the heat under the line with a vertical sun not exceeding 82°, and that of the water being nearly equally great; for instance, 80° or 81°: the rare occurrence of dew, the great humidity of the atmosphere, &c.

"These circumstances, I need not point out to you, throw considerable light on the established facts of the great salubrity of sea-voyaging, and its excellency as a remedy for pulmonary affections; the great purity of the air, in which not a particle of dust floats or the minutest insect moves, likewise must be noticed, not to dwell upon the gentle exercise of the body.

"The temperatnre of the human body has also occupied my attention; and the observations I have made seem to me interesting, and particularly as shewing how long exposure to heat predisposes to febrile affection, by augmenting the

temperature of the system; I must barely state my results without further comment.

"In Europe, the average temperature of the human body is 98°. In most on board it was no higher out of the tropic; under the Line it had increased one degree; and in about 12° South, it was augmented to nearly 100°.

"I have not neglected the opportunity that offered of ascertaining the temperature of different animals. The temperature of all the fish I have tried exceeded that of the water in which they were caught, by two or three degrees. The temperature of the turtle was still higher, nearly by ten degrees; and that of the porpoise was as high as 100°; thus not inferior to the temperature of most of the animals that inhabit the land, and consume a greater quantity of air in respiration. My observations on the heat of birds and insects are yet scanty; when more numerous, you shall know the results.

"I must not conclude without saying a few words respecing the Cape. The town seems as if it was just transported from Flanders. The scenery around it is beautiful and romantic, and to us on landing, it appeared a paradise. The productions of Europe are mingled with those of Africa, and side by side are strongly contrasted. The gardens have the appearance of an immense hot-house, and the town that of a menagerie; and I am sorry to say the low state of morals prevalent here, the want of taste for intellectual pursuits, and the slavish condition of the great mass of the population, strengthen the degrading idea. Let me pass to the natural objects, many of which may be contemplated with pleasure. The forms of the rocks are sublime, and their arrangement curious. The Table-hill is the most intesesting of the mountainous groupe that I have examined in the neighbourhood. It is composed of sand-stone, granite, and schistus. The first mentioned rock which forms the summits, and at least two thirds of the whole mountainous mass, is silicious, and in many places passes into conglomerate; it rests on granite, and the granite itself apparently rests on schist, into which it ramifies in a very curious manner. The schist resembles precisely the killas of Cornwall."

On the Decomposition of Light by simple Reflexion.

We understand that Dr. Brewster has lately discovered that white light may be decomposed into its complementary tints by simple reflexion, from the separating surfaces of transparent media, either solid or fluid, that differ in refractive and dispersive power. If a film of oil of cassia, of any thickness, is interposed between two prisms or plates of flint glass, the light reflected from the first surface of the fluid film will be of an uniformly brilliant blue colour, at every angle of incidence, while the transmitted light has a pale, straw-yellow tint. If the action of the oil of cassia is reduced by the admixture of oil of olives, till the mean refraction of the compound fluid is exactly equal to the mean refraction of the flint-glass, the blue light is still reflected with some modification of its tint. If the red rays are equally acted upon by the solid and the fluid, then the intensity of the blue light will be a maximum ; and if the blue rays are equally acted upon, the reflected light will be of a dingy yellow colour. By knowing the refractive and dispersive powers of the bodies which are combined, the reflected and transmitted tints, may, in every case, be determined *à priori*. From these experiments, it is demonstrable, that whenever white light passes from one medium into another of a different dispersive power, perfectly transparent, the reflected and refracted pencils can never be perfectly white, but must experience a certain modification of tint, depending on the different actions of the combined media. The colour of natural bodies may frequently be produced and modified by this cause.

These results have led to a much more important discovery respecting the production of the complementary colours by *reflexion from the separating surfaces of media that have the same refractive and dispersive power*; of which we expect to be able to give some account in our next Number.

Map of Turkey.

General Guillaume de Vaudoncourt is about to publish in this country a general Map of European Turkey on the *right of the Danube.* This Map has been constructed with great care, and under circumstances peculiarly advantageous, exclusive of the information derived from a considerable portion of original geographical descriptions, and actual surveys by scientific persons, in the author's possession. General Vaudoncourt devoted a very considerable portion of his time, whilst in Turkey, to making notes and surveys of the most important objects necessary for the undertaking, more especially with regard to the situation of the principal places which have been determined by thirty-three astronomical observations. The Map also contains all the lines of communication existing in the country, and is on a scale of $\frac{1}{1000000}$ of the country delineated, being about 5 lines for 7 English miles. The surface of the map extends in length from the 12th to the 28th degree of east longitude from the meridian of Paris, under the 45th parallel; and in width from the 36th to the 46th degree of north latitude. It will be accompanied by a Memoir, detailing the different sources of the author's information, and of the method used in constructing the Map, together with notices respecting the different places remarkable in antiquity. The Memoir will also contain a list of the roads to serve as an itinerary.

The Map, which is to be engraved by the author, consists of nine sheets, 16 inches 3 lines in length, and 14 inches 3 lines in breadth.

General Vaudoncourt, who was engaged in Turkey for a considerable time during the reign of the Emperor Napoleon, on a political mission, is already known as the author of "an Account of the Expedition of the French army to Moscow," and of the "History of the Ionian Islands."

A new species of moveable polarisation has, we understand, been lately discovered by Dr. Brewster, in which the complementary tints never rise above the *white of the first order*, by the successive application of the polarising influence.

The Gazette of Florence attributes the true discovery of the Steam-boat to D. Seraphin Seratti du Mont Capi, and cites an extract from a letter in the works of that person. Lettres sur divers objets de physique experimentale. Florence, 1787.

VI. *Plan of an Extended and Practical Course of* LECTURES *and* DEMONSTRATIONS *on* CHEMISTRY, *to be delivered in the Laboratory of the Royal Institution. By* WILLIAM THOMAS BRANDE, *Fellow of the Royal Societies of London and Edinburgh, Professor of Chemistry in the Royal Institution, and of Chemistry and Materia Medica to the Apothecaries Company.*

THESE Lectures commence on Tuesday the 8th of October, at nine in the morning, and are continued every Tuesday, Thursday, and Saturday.

Two Courses are given during the Season, which begins in October and terminates in May.

The Subjects comprehended in the Courses are treated of in the following order.

Division I. Of the Powers and Properties of Matter, and the General Laws of Chemical Changes.

§ 1. Attraction — Crystallization— Chemical affinity—Laws of Combination and Decomposition.

§ 2. Light and Heat—Their influence as Chemical Agents in art and nature.

§ 3. Electricity — Its Laws and connexion with Chemical phenomena.

Division II. Of Undecompounded Substances and their Mutual Combinations.

§ 1. Substances that support Combustion, Oxygen Chlorine, Iodine.

§ 2. Inflammable and acidifiable Substances — Hydrogen — Nitrogen—Sulphur—Phosphorus—Carbon—Boron.

§ 3. Metals—and their Combinations with the various Substances described in the earlier part of the Course.

Division III. Vegetable Chemistry.

§ 1. Chemical Physiology of Vegetables.

§ 2. Modes of Analysis—Ultimate and proximate Elements.

§ 3. Processes of Fermentation, and their products.

Division IV. Chemistry of the Animal Kingdom.

§ 1. General views connected with this department of the Science.

§ 2. Composition and properties of the Solids and Fluids of Animals—Products of Disease.

§ 3. Animal Functions.

Division V. Geology.

§ 1. Primitive and Secondary Rocks—Structure and situation of Veins.

§ 2. Decay of Rocks—Production of Soils—Their analysis and principles of Agricultural improvement.

§ 3. Mineral Waters—Methods of ascertaining their contents by Tests and by Analysis.

§ 4. Volcanic Rocks—Phenomena and Products of Volcanic eruptions.

In the First Division of each Course, the principles and objects of Chemical Science, aud the general Laws of Chemical Changes are explained, and the phenomena of attraction, and of Light, Heat, and Electricity developed, and illustrated by numerous experiments.

In the Second Division the undecompounded bodies are examined, and the modes of procuring them in a pure form, and of ascertaining their chemical characters exhibited upon an extended scale.—The Lectures on the Metals include a succinct account of Mineralogy, and of the methods of analysing and assaying Ores.

This part of the Courses will also contain a full examination of Pharmaceutical Chemistry; the Chemical Processes of the Pharmacopœia will be particularly described, and compared with those adopted by the Manufacturer.

The Third and Fourth Divisions relate to Organic Substances.

—The Chemical changes induced by Vegetation are here inquired into; the principles of Vegetables, the theory of Fermentation, and the character of its products are then examined.

The Chemical History, of Animals is the next object of inquiry—it is illustrated by an examination of their component parts, in health, and in disease; by an inquiry into the Chemistry of the Animal Functions, and into the application of Chemical principles to the treatment of Diseases.

The Courses conclude with an account of the Structure of the Earth, of the changes which it is undergoing of the objects and uses of Geology, and of the principles of Agriculture and Chemistry.

The applications of Chemistry to the Arts and Manufactures, and œconomical purposes, are discussed at some length in various parts of the Courses; and the most important of them are experimentally exhibited.

The Admission Fee to each Course is Four Guineas: or by paying Eight Guineas, Gentlemen are entitled to attend for an unlimited time.

Further particulars may be obtained by applying to Mr. Brande or to Mr. Fincher at the Royal Institution, 21, Albemarle street.

The Editor thanks the writer of the letter signed S, for his information concerning the Water Ram, and for his reference to Mr. Nicholson's remarks (Journal, Vol. xiv. p. 110.) Although Mongolfier was decidedly not the original inventor, he has the merit of rendering the machine self-acting, which seems all that Mr. Millington claims for him.

Mr. Cooper's Experiments on the Oxides of Platinum are reserved for the next Number, as he wishes to extend them.

It is particularly requested that papers may be forwarded to the Editor one month previous to the publication of the Number in which it is wished they should appear, and earlier if possible, where there are plates.

ART. XXII. METEOROLOGICAL DIARY for the Months of June, July, and August, 1816, kept at EARL SPENCER'S Seat at Althorp, in Northamptonshire. The Thermometer hangs in a north-eastern aspect, about five feet from the ground, and a foot from the wall.

METEOROLOGICAL DIARY

for June, 1816.

		Thermometer.		Barometer.		Wind.	
		Low.	High.	Morn.	Even.	Morn.	Even.
Saturday	1	40,5	69	29,88	29,89	NW	W
Sunday	2	52	72,5	29,85	29,85	W	WNW
Monday	3	39,5	60	29,85	29,90	W	WNW
Tuesday	4	41	63	29,90	29,83	W	WNW
Wednesday	5	44,5	60	29,75	29,64	W	N
Thursday	6	38	52,5	29,72	29,78	NNW	NNW
Friday	7	47	58	25,61	29,45	W	WSW
Saturday	8	48	56	29,33	29,32	WSW	W
Sunday	9	43	54,5	29,18	29,28	W	WNW
Monday	10	41	57	29,50	29,66	N	W
Tuesday	11	45	64	29,84	29,84	W	SE
Wednesday	12	39	69	29,95	29,94	WSW	SW
Thursday	13	46,5	69	29,91	29,88	SW	WSW
Friday	14	42	56	29,90	29,93	NW	E
Saturday	15	47	58	29,90	29,90	NE	NE
Sunday	16	42	57	29,90	29,90	NE	ENE
Monday	17	39	70	29,90	29,74	WbS	WbS
Tuesday	18	39	68	29,80	29,80	SW	W
Wednesday	19	51	67,5	29,81	29,85	W	W
Thursday	20	45	72	29,96	29,96	WbS	S
Friday	21	53	71,5	29,96	29,94	E	NbE
Saturday	22	46	69,5	29,94	29,90	E	EbN
Sunday	23	52,5	62	29,71	29,63	SE	SW
Monday	24	51	62	29,69	29,75	WNW	WNW
Tuesday	25	46	71	29,83	29,83	W	E
Wednesday	26	50	67	29,72	25,51	E	ESE
Thursday	27	49	61	29,51	29,70	NE	NE
Friday	28	47	68	29,88	29,92	NE	NE
Saturday	29	48	74	29,95	29,86	SE	SE
Sunday	30	48	69,5	29,75	29,63	SE	S

METEOROLOGICAL DIARY

for July, 1816.

		Thermometer.		Barometer.		Wind.	
		Low.	High.	Morn.	Even.	Morn.	Even.
Monday	1	50,5	63	29,59	29,60	W	NNE
Tuesday	2	43	71	29,64	29,64	W	SW
Wednesday	3	50	67	29,64	29,68	W	W
Thursday	4	42	61,5	29,69	29,57	W	SW
Friday	5	50	62,5	29,60	29,69	N	E
Saturday	6	42	61	29,72	29,64	SE	SE
Sunday	7	53	61	29,53	29,50	SE	W
Monday	8	45,5	64	29,53	29,49	SE	E
Tuesday	9	48	65	29,50	29,50	SE	SE
Wednesday	10	49	65	29,45	29,42	SE	W
Thursday	11	42,5	65	29,48	29,49	W	NNW
Friday	12	50	62	29,55	29,65	W	NW
Saturday	13	47	65	29,74	29,75	W	WbN
Sunday	14	41,5	60	29,72	29,55	SE	SW
Monday	15	52,9	65,5	29,50	29,50	E	WbS
Tuesday	16	45	67	29,51	29,51	SW	E
Wednesday	17	53	66	29,48	29,30	W	SE
Thursday	18	46	59,5	29,20	29,25	S	SW
Friday	19	46	62,5	29,32	29,34	E	WSW
Saturday	20	58	71,5	29,50	29,52	SE	ESE
Sunday	21	60	69,5	29,36	29,40	SE	SW
Monday	22	52	64	29,54	29,59	W	SW
Tuesday	23	52,5	68	29,48	29,43	SSE	SE
Wednesday	24	53	69	29,45	29,45	W	NW
Thursday	25	51	67	29,47	29,55	WbN	ENE
Friday	26	54	66	29,59	30,77	NW	W
Saturday	27	53	64	29,80	29,74	W	W
Sunday	28	49	60,5	29,68	29,64	W	S
Monday	29	47	61,5	29,59	29,50	NW	S
Tuesday	30	47	62,5	29,45	29,39	W	W
Wednesday	31	42	64	29,39	29,37	W	NW

METEOROLOGICAL DIARY

for August, 1816.

		Thermometer.		Barometer.		Wind.	
		Low.	High.	Morn.	Even.	Morn.	Even.
Thursday	1	47,5	62,5	29,41	29,55	W	W
Friday	2	50	67	29,62	29,64	W	SW
Saturday	3	46	66,5	29,64	29,69	W	WbN
Sunday	4	41	67	29,75	29,70	W	NW
Monday	5	49	66	29,70	29,69	NW	NW
Tuesday	6	43	65	29,78	29,78	W	S
Wednesday	7	54	68,5	29,70	29,69	SW	S
Thursday	8	56	65,5	29,60	29,58	S	W
Friday	9	43	64	29,58	29,62	W	W
Saturday	10	42	63	29 80	29,85	W	WbS
Sunday	11	53	63,5	29,85	29,82	WbS	WbS
Monday	12	50	66	29,89	29,90	WbS	W
Tuesday	13	52	67,5	29 89	29,81	WbS	NW
Wednesday	14	44	62	29,69	29,50	W	E
Thursday	15	55	63,5	29,40	29,32	E	SSW
Friday	16	52	59	29,36	29,59	W	W
Saturday	17	49	60	29,66	29,75	W	WNW
Sunday	18	49	61,5	29,87	29,93	W	WNW
Monday	19	47	62,5	30,02	30,03	W	WbN
Tuesday	20	54	61	30,01	30,01	NNW	E
Wednesday	21	36	63	30,07	30,09	S	WbN
Thursday	22	53	65	30,05	30,02	NW	NE
Friday	23	54	64	30,02	30,00	NE	WNW
Saturday	24	51	67,5	30,01	30,04	W	E
Sunday	25	43	65	30,10	30,07	WNW	NW
Monday	26	52	61	30,07	30,03	ENE	NE
Tuesday	27	49	63,5	30,05	30,05	SW	NbE
Wednesday	28	40	65	30,09	30,08	E	NNW
Thursday	29	47	60	30,07	29,95	W	W
Friday	30	50	59	29,82	29,70	W	W
Saturday	31	48	53	29,20	29,10	ESE	NNE

A Quarterly List of Foreign Publications, from July, 1816, *to the end of September*, 1816.

Natural History.

Histoire naturelle des Animaux sans vertèbres, par Mons. Le Claval Delamarck. 3 vol. 8vo. Paris.

A. Risso, Histoire naturelle des Crustacés des Environs de Nice. 1 vol. 8vo. plates.

Essai sur l' Histoire de la Nature, par MM. Gavotz et Toulouzan, 3 vol. 8vo. pp. 1800.

Herold, *Entwiklungs-Geschichte*, &c. Histoire anatomique et physiologique du developpement des Pavillons, 1 vol. 4to. plates.

Mémoires de la Société Imperiale des Naturalistes de Moscow, 2 vol. 4to. 24 plates.

Gaëde, Beitrage, &c. or Memoir on the anatomy and physiology of the Medusæ. Berlin, 8vo. plates.

Hoppe, Enumeratio Insectarum elytratorum circa Erlangam indigenarum. Erlang. 1 vol. 8vo. plates.

Modeer, Bibliotheca Helminthologica, 8vo. Erlang.

Botany.

Neonographia de Potentilla, Auctore Nestler, M. D. Strasbourg, 1 vol. 8vo.

Flore du Dictionnaire des Sciences Medicales, 25 livraison.

Gallesio, Theorie de la Réproduction vegetale. Vienna, 1 vol. 8vo.

Plato, Giftpflansen, &c. On the poisonous Plants of Germany. Leipsic, 1 vol. 8vo.

Gainepel, Abbildung der Teutschen Holtzarten. Or Description of the indigenous Trees of Germany. 19th and 20th Numbers, plates. Berlin.

Chemistry.

Davy, Elementi di Chimica Agraria, tradotti in Italiana da Targioni Tozzeti. 2 vol. 8vo.

Gilbert, Annalen der Physik, &c. Number for January and February.

Schweigger, Neues Journal der Chemie, &c. same Number.

Starke, Beschreibung. Description of meteorological Instruments and their use, vol. 4to. plates. Nuremberg.

Sangiorgio, Dissertazione sul Vetro idrostatico impiegato a conoscere la gravità specifica, de' Corpi. Milan, 1 vol. 8vo.

Bibliothèque universelle des Sciences et des Arts. Geneva, January, February, March, April, May.

Giornale di Scienze e d'Arti. Florence.

Biblioteca Italiana di Scienze e d' Arti. Milan, 3 Numbers.

Giornale Enciclopedico di Napoli. Numbers for March and April.

Giornale di Fisica di Brugnatelli. Second *bimestre*. Pavia.

Dagoumen, Essai sur le Gaz azote atmosphérique. 8vo. Paris.

Mineralogy and Geology.

Parrot, Grundriss der Physick der Erde, &c. Elements of *Geology. 1 vol. 8vo. plates, Riga.*

Freierleben, Geognostische Arbeiten, or, Geognostic Memoirs, in 3 vol. 8vo plates, and a map.

Pohl, Ueberblik, &c. or, a systematic Table of simple Fossils. vol. 4to. Prague.

Hoffman, Handbuch der Mineralogie, &c. Elements of Mineralogy, the 2nd vol. Freiberg.

Vesi, Storia fisica della Terra, &c. Milan, 8vo.

Agriculture and Rural Economy.

E. V. Crud, Principes raisonnés d'Agriculture, traduit de l'Allemand de *Thaer*, Geneva, 1 vol. 8vo.

Guevient, Essai sur les Epizooties, Paris, 1 vol. 8vo.

Chatenain, Mémoire sur les Chevaux arabes, 1 vol. 8vo.

Decapitani, Sull' Agricultura, particolarmente nei Paesi di Montagne, &c. 1 vol. Milan.

Biblioteca dell' Agricoltore, tom. ix. x. xi. xii. 4 vol. 8ov. Florence.

De la Bergerie, Histoire de l'Agriculture Française, Paris, 1ol. 8vo.

Petri, Das ganze des Schaafzucht, &c. or a complete Method for the preservation of Merinos, 8vo. Vienna.

Rè, Nuovi Elementi d' Agricoltura, 8vo. Milan.

Geography.

Barbié de Bocage. &c. Atlas pour servir à l'histoire ancienne, 1 vol. 4to. maps and plates.

Carte de l'Europe centrale, donnant toutes les nouvelles divisions des états d'après les derniers traités de Vienne et Paris.

Sotzaman, Carte du Royaume d'Hanovre et des pays limitrophes, Nuremberg

Medicine, Surgery, Anatomy, and Physiology.

Porinelle, des Etudes du Medecine, de leurs connexions, et de leur methodologie, Pamp. 4to.

Nauche, Maladie de l'Uterus, ou de la Matrice, 1 vol. 8vo.

I. S. Ch. Nosographiæ compendium e novissima Neographiæ philosophicæ editione excerptum, 8vo. 1 vol. pp. 500.

Conveilhier, Essai sur l'Anatomie pathologique en général, et sur les transformations et productions organiques en particulière, 2 vol. 8vo. Paris.

Eveillé, Mémoire sur l'état actuel de l'Enseignement de la Medecine, et de la Chirurgie en France, 1 vol. 4to.

Medizinische Annalen, Annals of Medicine and Surgery, Numb. for Jan. Feb. March, 1816.

Sprengel, Institutiones Pharmacologiæ, Leipsic, 1 vol. 8vo.

Harles, Opera minora academica medica, &c. Leipsic, 1 vol. 8vo.

Reil, Elements of Pathology, Halle, 2 vol. 8vo.

Bernhardi, *Handbuch*, &c. Traité de la Contagion gén. tom. i.

Stein, Neue Annalen, or, New Annals of Midwifery.

Hecker, Handbuch, or complete Manual of Military Surgery, and Medicine, 1 vol. 8vo. Gotha.

Hufeland, Journal der practischen Heilkunde, or Journal of practical Medicine, Numb. of March.

Recueil général de Medicine, Paris, 8vo. June and July.

Journal Universel des Sciences medicales, May.

Annales chimiques de Montpellier, May and June.

Grimaldi, Elementi di Anatomia, 11 vol. 8vo.

Panvini, Rimedj preservativi dalla Peste, Naples, 8vo.

Billard, Dissertations françaises et latines sur les points les plus importans de l'art de guerir, Paris, 8vo. 2 parts.

Freteau, Traité élémentaire sur l'Emploi legitime et méthodique des émissions sanguines dans l'art de guerir, 1 vol. 8vo.

Giraudy, Traité de Thérapeutique général, 8vo. Paris.

Remer, Police Judiciaire pharmaco-chimique, translated into French from the German.

Gardanne, Avis aux Femmes qui entrent dans l'âge critique 1 vol. 8vo. Paris.

Denis, Recherches chimiques et medicales sur l'uroscopie, 8vo. Paris.

Achard-Lavost, Principes de Thérapeutique appliquée aux Maladies internes, 8vo. Paris.

Mémoires sur les Maladies croniques, les évacuations sanguines, et l'acupuncture, 8vo. Paris.

Mechanic Philosophy and Mathematics.

Thilorier, Système universel, ou de l'Univers et de ses phenomènes considérés comme les effets d'une cause unique, 4 vol. 8vo. plates,

Biot, Traité de Physique experimentale et mathématique, 4 vol. 8vo. plates.

Dubuat, Principes d'hydraulique et de pyrodynamique, &c. the 3d. vol. 8vo.

Antoine, Elémens d'Arithmetique, 3d Edit.

Gorgone, Annales de Mathématiques pures et appliquées, sixième annèe, No 1, 2. 3, plates.

Lindenau et Bohnenberger, Zeitschift für Astronomie, or, a Journal of Astronomy and astronomical Science, Jan. Feb. March, April.

Wiebeking, Theoretische und practische wasser Baukunst, &c. or, Theoretical and practical Hydraulic Architecture, Munich, 3 vol. 4to. plates.

Doppio Soffietto, &c. Double Bellows, by means of which, assistance may be given to the apparently drowned, and other physical or chemical researches executed. By Professor Configliacchi.

Muncke, *Physikalische Abhandlungen*, &c. or, Essays on the History of Nature, Marburg, 8vo.

Memorie di Matematica e Fisica della Società Italiana delle Scienze, Verona, 17th vol.

Elementi di Elettrometria animale. Elements of animal Electrometry, by Amoretti, Milan, 8vo. plates.

Hachette, Correspondence sur l'Ecole polytechnique, 3 Num. of the 3d vol. Paris, 8vo.

Legendre, Supplément à la seconde Edition de la Théorie des Nombres, Paris, 8vo.

Voyages and Travels.

M. Chateaux-Vieux. Lettres écrites d'Italie en 1812 et 1813, 2 vol. 12mo. Geneva.

L. V. D. Lettres sur la Guerre de Russie en 1812, 1 vol. 8vo.

Londres, la Cour et les Provinces, d'Ecosse, d'Angleterre, &c. Voyage d'un Français en Angleterre.

Henry, Voyage en Abyssinie par ordre du Gouvernement Britannique, par Mons. Salt.

London: Printed by W. Bulmer and Co.
Cleveland-row, St. James's.

CONTENTS

TO

No. IV.

CONTENTS.

CONTENTS.

JOURNAL *of* SCIENCE *and* ARTS, *edited at the Royal Institution.*

Notwithstanding the large Impression of the First Numbers of this Journal, their very rapid Sale has already called for an extensive Reprint.

The Second Editions of the first two Numbers (forming the First Volume), are ready for delivery, at Mr. Murray's, in Albemarle-street.

ERRATA.

Vol. I. Page 170. l. 11; from bottom, *for* bull-tuber *read* bulb-tuber.
p. 172. l. 17, from bottom, for *brevilius* read *brevifolius.*
Vol. II. p. 42. l. 15, *for* fire or axe are, *read* fire or axe is.
p. 54. l. 3 from bottom, *after* the word surface, *insert* of the rock.
p. 263. line 10, *for* proportions *read* properties.
p. 278. line 21, *for* from *read* form.
p. 258. line 2, *for* consider *read* considers.
p. 260. line 17, *for* calorific *read* colorific.
p. 265. 3d line from bottom, *after* bodies *insert* "

THE QUARTERLY JOURNAL

OF

SCIENCE AND THE ARTS.

Art. I. *On the Laws of Muscular Motion.* *By* J. R. Park, *M. B. F. L. S. M. R. I.*

While every true friend to science laments the want of fixed principles in physiology, and the consequent uncertainty that prevails in medical reasoning; there are some who willingly avail themselves of this plea for neglecting its study, and idly exult in the assertion, that we have not sufficient knowledge of the animal economy to entitle this branch of philosophy to rank with the sciences.

Certain it is, that this want of fixed principles is a fruitful source of the many fanciful theories daily put forth, which reflect discredit on the medical profession, and weaken the confidence of the public in those who practise it.

Nor can any reasonable hope be entertained, that these visionary speculations will be effectually repressed, until the fundamental laws of animal life are more distinctly ascertained, and more regularly taught in medical schools.

With the fullest conviction of the utility of such an investigation, as well as a consciousness of the difficulties attending it, the attempt has been already made, by a careful analysis of the effects, to resolve into general principles the phenomena presented by the faculty of sensation.

There yet remains another primary attribute of animal life, which equally claims our attention, and presents phenomena no less interesting or important. This is the power of motion.

Motion is performed by means of muscular fibres; and all the functions of the body will be found to depend, either directly or indirectly, upon muscular contraction; the phenomena of which, when carefully examined, will also lead us to the knowledge of some general principles.

The power of motion, like the faculty of sensation, presents itself to our notice under a two-fold form.

As sensation, when subservient to what are termed animal functions, is attended with consciousness in the mind, as in the impressions made upon our organs of sense; so motion, in the same class of functions, is accompanied or preceded by an effort of the will, as in the voluntary exertion of our limbs.

But on the other hand, as sensation in automatic or organic functions is unattended by mental perception; this being the case with impressions on internal organs: so muscular motion, in this class of functions, is performed without any act of volition; as in the actions of the heart, stomach, and intestines.

Voluntary and involuntary motion present phenomena so different, as to have led some eminent physiologists to regard them as distinct faculties, radically different in their nature. By a separate consideration of each, it will the more readily be shewn, what ground there is for this conclusion.

Voluntary motion is allowed by all to consist in an altered condition of the moving fibre, produced through the intermediate influence of the brain and connecting nerves.

The nature of the change effected is a longitudinal approximation of the particles composing the fibre; producing a consequent diminution of its length, with some little increase of its thickness.

That very little general change of bulk however attends, has been proved experimentally, by immersing the arm in water, previously to contraction, and then throwing the muscles into action; which caused no perceptible change in the height of the fluid, though contained in a vessel with a graduated tube affixed to it, in such a manner as to have detected the slightest variation of bulk in its contents.

The means or agent that causes this change of condition in the moving fibre, is, however, the point which has most engaged the attention of physiologists, when it might perhaps have been more profitably employed in considering the effects. It will, therefore, be proper to state the prevailing opinions respecting the cause of contraction, before we proceed to deduce the laws of motion, from observance of its phenomena.

The most distinguished writers on this subject, Haller, Whytt, and Bichât, concur in admitting the agency of the nerve to be essential to the production of motion, when it is voluntary: but they differ in opinion as to the kind of agency it exerts.

Haller regarded contractility as a faculty inherent in the muscle, requiring only a stimulus to excite or call it forth. This power of exciting he ascribed to the nerve, acting under the control of the brain, and differing from other modes of irritation, in respect only to its greater force and activity.

Whytt, on the other hand, objected that this view was allotting to the muscle the property of sensation, as well as that of motion; for in fact, says he, a part must be sensible to irritation, and feel before it resists.

According to Whytt, the brain alone feels or is conscious of impressions transmitted to it through the nerves; and reacting through the medium of the nerves, imparts to the moving fibre something which operates upon it in such a way as transiently to alter its state of aggregation. Something which acts upon the muscle, not as a mere exciting cause, to call forth the exertion of an inherent power; but as the direct agent, or efficient means in producing the change of condition that ensues.

Bichât, when speaking of the share which the nerve has in producing voluntary motion or animal contractility, also calls it the essential agent, which transmits to the muscle the principle of motion, Anat. Générale, Tom. 1, p. 174.

"Nous verrons qu'ils sont les agens essentiels, qui leur transmettent le principe du mouvement; en sorte que la contractilité animale suppose toujours trois actions successive-

ment exercées, savoir, celle du cerveau, des nerfs, et des muscles."

This opinion of Bichât and Whytt is not only more simple and satisfactory than that of Haller, but will also be found more consonant with the phenomena.*

But after all, it is no more necessary that we should ascertain the nature of the agent by which muscular contraction is effected, or that of the change it produces, in order to come at the general laws of motion, than it is necessary to discover the cause of gravitation, in order to find out the laws of inanimate matter.

The laws of muscular motion, like those of matter, must be deduced from the phenomena. To these then we shall now turn our attention.

The most familiar and remarkable circumstance attending voluntary motion, is the progressive change which the powers of action undergo from continued exertion.

When we begin to move our limbs, we usually find the first efforts are comparatively feeble and inert. But as we continue our exertions, until we grow warm with action, the energies of the body are gradually developed, and we soon attain to the full possession of our strength and activity. After a further period of exertion, this state of vigour and activity is succeeded by a sense of uneasines, which we call fatigue; and eventually we are compelled to desist from our efforts by the painful sensation they occasion, or the want of power to continue them.

These changes, though subject to considerable variety, in regard to degree and duration, may yet be perceptibly traced through all voluntary organs; and from these we may venture, without any knowledge of the cause that produces them, to lay down the following as laws of muscular motion.

1. That exertion is productive of certain changes in the organs of motion, which are accompanied by corresponding changes in the powers of action.

2. That the powers of action have certain limits prescribed to them, which sooner or later require the renovation derived from rest.

The progressive changes which the powers of action undergo, from continued exertion, vary in almost every organ; and are subject to further variation from the influence of habit; but for the sake of precision, they may be distinguished into three stages.

First,—The stage of inertia, or comparatively inefficient activity.

Secondly,—The stage of vigour, or the period of energetic action.

Thirdly,—The stage of fatigue, or painful and difficult exertion.

The degree of rest that is required to restore the powers of action, also varies according to the nature of the organ, the previous degree of exertion, and the influence of habit. But however rapid the renewal of power in some parts, or however protracted the period of exertion in others, still all voluntary organs manifestly have certain limits, beyond which the continuance of action becomes impossible, and rest indispensable.

Although the operation of these laws at present is restricted to voluntary organs, yet it will hereafter be seen, that they equally apply to those which are involuntary, and really admit of no exception. And this universality of the law certainly affords a presumptive proof that these alternations of action and rest proceed from some physical necessity, some change of condition in the moving organ, which is inseparable from muscular contraction.

Without inquiring into the nature of the nervous influence, we may readily conceive the probability of its producing such changes as those in question.

If, as some suppose, it be at all analogous to the galvanic energy in its mode of operation; it seems in no wise improbable, that its first applications should not produce their full effect on the muscular fibre; and therefore that the powers of action should not at once be fully developed.

That the fibre should gradually become more susceptible of its influence, as we grow warm with action, seems also

every way probable; and thus we should expect that the powers of action would for a time increase with exertion.

Further, that the repeated application of so powerful an agent, should at length produce changes that are excessive and painful, is analogous to what occurs from all other changes that are too rapid in their production, or too considerable in degree.

This view, however, is not offered for the purpose of establishing any supposed affinity between the nervous and galvanic energy; but merely to shew, that this supposition accords as well with the phenomena, or even much better, than another, which, though extensively received, is apparently erroneous, and requires to be refuted, as, in many respects, calculated to mislead.

The opinion contended for is this: that the sensation of fatigue arises from a change of condition in the moving fibre, effected by the repeated application of the nervous influence. Of this change, no matter what be its nature or cause, the mind becomes conscious when it arises at a certain degree, because the muscular structure, like every other, has some portion of nerve blended with its substance, and entering into its composition.

The opinion to be combated is this: that the sense of fatigue arises from the expenditure or exhaustion of that power or energy imparted by the nerve to the moving fibre; and not from the changes produced by its repeated application.

If not an offspring of the Brunonian hypothesis; this doctrine is so nearly allied to it, that a brief outline of that system is necessary to place it in a clearer point of view.

The system alluded to, was about the same period advanced by Brown and Darwin; and soon obtained disciples, by its apparent simplicity, which promised to save the trouble of any further research, and explain, in a summary way, all the mysteries of our nature.

We were only required to admit, that the brain is capable of secreting or generating a certain energy, termed by Dr. Brown, Excitability, and by Dr. Darwin, Sensorial Power; and allow this to undergo various degrees of accumulation

and expenditure, and its different states of fluctuation were deemed adequate to explain all the leading phenomena of life.

A deficient expenditure of this power was conceived to occasion *direct debility*, by allowing a morbid accumulation.

An excessive expenditure was said to cause *indirect debility*, by producing an exhaustion of this power.

Every impression acting upon the mind or body, and every action exerted by it, were conceived to occasion a loss or expenditure of excitability; fatigue was, therefore, a state of indirect debility, proceeding from immoderate expenditure of sensorial power.

A very able refutation of the many sophisms and inconsistencies which are involved in this doctrine, will be found in the Observations on Zoonomia, by Dr. Brown, the present professor of Moral Philosophy in Edinburgh; a work of great merit, displaying an uncommon share of ingenuity and metaphysical acumen in the author, at an early period of life. It would be foreign to our purpose to enter further into the subject at present.

That the excitability of Brown, the sensorial power of Darwin, and the nervous energy of Whytt and other physiologists, are only the same thing, under different denominations, is easily perceived. The question is not, as to its nature, but whether its expenditure and exhaustion are to be regarded as the cause of fatigue; which appears liable to the following objections.

In the first place,—The assumption on which it rests is gratuitous and unfounded.

Secondly,—The phenomena are incompatible with this supposed cause, if its existence were proved.—And,

Lastly,—They all perfectly accord with the view already offered, of a change in the moving fibre itself; which, moreover, may be directly proved to take place.

To return.—The assumption that the nervous energy is liable to be exhausted in the living body, appears unfounded.

This exhaustion, if it occur, must be either partial, or general. We will first suppose it partial.

Whatever be the nature of this fluid, power or energy, rapid

diffusibility is one of its most indisputable properties. The experiments of Dr. Wollaston, related in the Croonian Lecture for 1810, which render it probable that every muscular contraction consists of a number of separate shocks, following each other in such rapid succession, as to appear only a single effort of contraction, may convey some idea of the amazing velocity with which this energy is imparted by the nerve to the muscular fibre.

From this rapid diffusibility then, it would be expected, that the effects of a partial expenditure should be no longer felt than the time required for the exhaustion in one part to be replenished from others, or from the general reservoir, the sensorium, according to the Brunonian doctrine.

How is it then, that the pain of fatigue, and the effects of over-exertion, often last for many days or even weeks? Is this power so slowly diffused, or is it so long in reaccumulating?

But the exhaustion of excitability may be general, which we will next suppose it to be.

If the cause be general, the effects should be so likewise, and the over-exertion of one limb or organ should cause the sense of fatigue to be felt in others, or in all. This, however, is so far from being the case, that an extraordinary exertion may incapacitate one arm for several days, and the rest of the body feel no participation.

During the period of exertion, when the effort begins to excite painful sensation, merely changing the mode of action is often sufficient to alleviate weariness, even in the same limb, by calling other fibres into action, and allowing those to rest which were previously exerted.

Now, the pain should not be thus removed, by merely directing the nervous energy into a fresh channel, if its expenditure, and not its application, were the exciting cause of that pain.

Thus, there seems no ground for supposing such an expenditure of the nervous energy to take place, as to occasion pain from either a partial or general exhaustion.

But, secondly, were such an exhaustion allowed to take

place; the sense of fatigue, and the phenomena of muscular action, are not reconcilable with this, if assumed as their cause.

If the powers of action depend solely upon the due accumulation of this energy, and at length are suspended, in consequence of its exhaustion; then the activity should uniformly decline as the power is expended, and finally cease altogether when the period of exhaustion arrives.

Instead, however, of this being the case, activity is usually found to increase with exertion. Thus, the first dance is generally the most fatiguing: and a judicious sportsman spares his horse till he grows warm with action.

Further, when the powers of action appear nearly exhausted, they are often suddenly renewed, by the very means which, according to the Brunonian doctrine, should cause a still greater exhaustion, namely, a strong impression on the mind: thus, a soldier, sinking under the fatigue of a long march, when roused by the unexpected appearance of an enemy, awakened by the sense of danger, or animated by the hope of glory, feels his strength suddenly recruited, and forgets his fatigue.

Now, as every impression on the mind causes a further expenditure of excitability, according to the Brunonian system, this, instead of restoring the strength, should further augment the indirect debility which already prevails; and thus, the phenomena of fatigue are incompatible with this exhaustion as their assumed cause.

Lastly, it remains to be shewn, that they are consistent with the conclusion, that fatigue is a sensation arising from a change in the condition of the moving fibre itself, effected by the continued application of the nervous energy; and that direct proof of the existence of this change may be offered.

The state of the moving organ, on the approach of fatigue, appears in fact to be that of over-contraction, and not that of relaxation in the muscles; and strong impressions on the mind, having a tendency to take off spasm, as proved by daily experience, and in a manner that will hereafter be explained, this immediately moderates the spastic state of the

muscle, and restores its powers of action; just as friction, cordials, or a warm bath, would equally produce the same effect in cases of over-fatigue.

The efficacy of such remedies, applied to the moving organs, under similar circumstances, further attests that they are the immediate seat of the change which takes place; were this proof wanting to establish the fact, that a spasmodic state of the muscles is the real cause of fatigue. Of this, however, we have still more direct evidence in the actual condition of the organs themselves.

As fatigue approaches, nothing is more common* than cramps or spasms in the calves of the legs, and the soles of the feet, denoting an excess, and not a want of contractility; therefore, not a deficient, but an excessive application of nervous influence.

And when at length exertion has been so long continued, that the power of motion is impeded, or supported with pain and difficulty, the condition of the muscles presents nothing like a state of relaxation, as if wanting the power to contract; but, on the contrary, a state of rigid firmness, wanting the power to relax. Both flexor and extensor muscles will be found at this period to be alike rigidly contracted, by which the limb is for a time immovably fixed, and the power of motion impeded, until this spastic state is removed, by means similar to those already mentioned; or until the contraction spontaneously subsides by rest and sleep.

Finally, we have the most conclusive evidence of the muscles being the seat of the changes that occur, in the sensible and visible appearance of these organs which succeeds to immoderate exertion. When the spastic state goes off, and is followed by a subsequent relaxation, which will be found to bear always a relation to the degree of previous over-action, what is now the condition of the limbs?

It is one which could not have been disregarded, were physiologists more disposed to reason from obvious facts, which experience presents, and less attached to fanciful hypotheses.

The state of the muscle is one approaching to actual

inflammation; in fact, a manifest change in the condition of its capillary vessels, attended with pain, heat, redness, and swelling,—a condition requiring often the application of leeches, cupping glasses, or other modes of local evacuation, to unload the distended and weakened vessels, previously to the employment of those means which are best calculated to restore their natural tone.

Such are the grounds on which the conclusion rests, that fatigue is not an exhaustion of nervous energy, but that the moving fibre itself undergoes some change of condition during exertion,—that this change for a time facilitates and augments the powers of action; then, after a further period, renders its continuance irksome or painful; and finally brings on a state approaching to tonic spasm, which partially impedes or wholly suspends the power of motion, until rest has relaxed the spasmodic contraction.

But to whatever conclusion we may come, respecting the nature of the changes that occasion these successive stages in the phenomena of motion; their actual occurrence is a matter of observation and experience, admitting of no doubt or dispute. And the laws deduced from them rest entirely upon the facts themselves; their truth and certainty being wholly independent of the accuracy of the explanation, here offered, of the cause that produces them.

The importance of these principles or laws of motion would be comparatively trifling, if their influence were confined to the class of voluntary organs, which alone we have hitherto considered; but few will be disposed to consider it so, if their operation can be shewn to extend also to those which are involuntary.

Voluntary and involuntary motion do certainly present many striking points of difference; but the question is, whether these be sufficient to constitute them distinct faculties, radically and essentially different in their nature, or only different modifications of the same faculty.

Whytt contended for their identity, and maintained, that involuntary, as well as voluntary organs, derive their power of action immediately from their nerves.

Haller denied their identity, and contended, that nerves, although the chief instruments in producing voluntary motion, have yet nothing to do with that which is involuntary.

Bichât inclines to the same opinion; which, if established, would afford the strongest support to his system; and he has consequently exerted his utmost ingenuity to furnish arguments in its favour, though, after all, he appears afraid to profess it.

His chief arguments are derived from direct experiment, and deserve the most attentive consideration; as any proof that the same physical means are not employed in the production of voluntary and involuntary contraction, would at once be conclusive against the identity of the faculties; whereas variations in the mode, duration, or power of action in the two classes, would only constitute them different modifications of the same, and not distinct faculties.

Bichât's experiments consist in galvanizing the nerves leading to muscles of each class; galvanism being the most powerful agent yet discovered for exciting muscular contraction; and thus bringing it to the test, whether the involuntary muscles can be affected through the medium of their nerves, as well as the voluntary.

When the voluntary muscles of an animal recently killed are submitted to the operation of galvanism, through the medium of the nerves from which they derive their power of motion, sudden and violent contractions, or convulsive motions, are produced by it. But, on the other hand, as Bichât informs us, when galvanism is applied to the nerves leading to involuntary organs, similar effects do not ensue.

In his Anatomie Générale, T. 3, P. 364, he says,—

" Je ne me suis pas contenté des agens ordinaires, pour m'assurer du defaut d'action actuelle des nerfs sur les muscles organiques;—J'ai employé le galvanisme, et je me suis assuré, que ce moyen de mettre en jeu les contractions musculaires, est très peu efficace, presque nul dans la vie organique."

That is,—galvanism was found to have very little, scarcely any, influence in exciting contractions in the muscles of organic life. Even Bichât could not say it had no influence.

But we proceed and follow him in the statement of his experiments and their results.

He allows that the experiment of Humbolt, and those of Jadelot, affords result different from his own. Speaking of one of Humbolt's, which he repeated, and which consisted in detaching the heart of an animal from the body, isolating one of its nerves, and trying to excite contractions, by galvanizing the isolated nerve, he thus expresses himself. Recherches Physiol. P. 318.

"Je l'ai tenté inutilement plusieurs fois ;—Cela a paru me reussir cependant, dans une occasion."

After several failures, he acknowledges that it did succeed once. Again, in P. 336 of the same work, he thus states the result of his own experiments on the stomach, rectum, and bladder.

"J'ai mis a decouvert les nerfs qui partent des ganglions pour aller directement à l'estomac, au rectum, à la vessie, et j'ai galvanizé par ce moyen ces divers organs.

"Aucune contraction ne m'a paru ordinairement en resulter ; quelque fois un petit resserrement s'est fait appercevoir, mais il etait bien faible en comparaison de ces violentes contractions qu'on remarque dans les muscles de la vie animale."

Here again he is obliged to acknowledge, that although in general no sensible effect was produced on the stomach, bladder, or rectum, yet sometimes a slight retraction or drawing together was perceptible, though widely different from the violent contractions produced in the voluntary muscles.

The following passage is taken from his Anatomie Générale, Vol. 3, P. 360.

"Je remarque, cependant, que l'irritation d'un des nerfs vagues ou de tous les deux, fait tout suite contracter l'estomac, comme cela arrive pour un muscle volontaire, dont on irrite les nerfs."

When we now reconsider the results of these experiments, and find, that Bichât himself is constrained to acknowledge that galvanism appeared to have some influence when applied to gangliac nerves, causing "un petit resserrement ;" that in

galvanizing the heart according to Humbolt's experiment, though it failed several times, yet it succeeded once:—and that the stomach contracts just like a voluntary muscle, from galvanizing the par vagum—it will not surely be contended, that these are results to warrant the conclusion, that nerves have no influence at all in producing the contraction of involuntary organs.

These experiments, on the contrary, afford direct proof of their possessing this power of throwing the muscle into action, though doubtless in a manner different from that in which they operate upon voluntary organs, producing contractions neither so sudden nor so violent.

Accordingly, Bichât draws pretty nearly the same conclusion; though his reluctance to admit any thing that weakened the basis of his favourite system, prevented his perceiving the legitimate conclusions to be drawn from his own experiments; which strongly tend to establish the truth of the position, that animal and organic, or voluntary and involuntary motion, are produced by similar means, and present similar phenomena; and consequently they afford no grounds for supposing them to be radically distinct faculties, however they may be modified in respect to their mode, degree, or duration of action.

In fact, the difference between the effect of irritation applied to the nerves leading to voluntary and to involuntary muscles, is scarcely more striking than that which appears when it is made to act upon different muscles of the same class, as experimentally ascertained by Bichât himself.

Thus convulsive contractions are most readily excited in those muscles which are naturally rapid and sudden in their mode of action, and least so in those which are naturally slow and uniform in their contractions.

In his Anat. Génér. T. 3, P. 276, 7, he says,—

" Je remarque que tous les nerfs de la vie animale ne paraissent pas aussi susceptibles les uns que les autres de transmettre aux muscles les diverses irradiations du cerveau. En effet, tandis que dans les maladies, dans les plaies de tête, dans nos expériences, &c. les muscles des membres entrent en

convulsion, ou sont paralysés avec une extrême facilité; ceux du ventre, du cou, et surtout de la poitrine, ne présentent ces phenomènes que quand les causes d'excitation ou d'affoiblissement sont portées au plus haut point."..........On pourroit faire une échelle de la susceptibilité des muscles pour recevoir l'influence cérébrale, ou des nerfs pour la propager, au haut de laquelle on placeroit les muscles des membres, puis ceux de la face, puis ceux du larynx, ensuite ceux du bassin et du bas ventre, enfin les intercostaux et le diaphragme. Ces derniers sont, de tous, ceux qui entrent le plus difficilement en convulsion ou en paralysie. Observez combien cette échelle est accommodée à celle de fonctions."......

If then, it appear, as Bichât states, that those muscles are most easily thrown into convulsive action, whose actions are naturally most sudden and violent; and those are least easily excited to sudden contraction, whose actions are naturally most regular and uniform; why is it to be wondered at, that the same difference of effect which attends the operation of other modes of exciting them to action, should also be found to result from the influence of galvanism?

In short, there appears no ground for supposing any radical difference between voluntary and involuntary motion, or that nerves instrumental to the production of the one, are not so to that of the other.

It is true, that contractions may be excited by causes of irritation applied directly to the muscles themselves, as well as to the nerves leading to them. But this circumstance by no means disproves the instrumentality of nerves, since their extreme branches are intimately blended with the structure of the muscle, and inseparable from its substance. This power, moreover, of contracting from direct irritation, is alike possessed by muscles of both classes, and forms therefore no ground of distinction between them.

The circumstance of the one being preceded by, or attended with an effort of volition, and the other not, can only be regarded as constituting them different modifications of the same faculty; just as sensation is still to be regarded as essentially the same, whether attended or unattended by conscious

reflection; and in both faculties this circumstance, of their occurring under a two-fold form, may be traced up to the same source, and shewn to result from the same cause.

The brain being equally the immediate organ of volition as well as reflection, the degree in which the motion of any part is subject to the control of the will, as well as the capability each part possesses of exciting mental perceptions, bears a relation to the intimacy of its nervous connection with the sensorium, or the proportion of nerves it derives from the cerebral, and that it receives from the gangliac system.

The muscles of the limbs, those of the face, of the organs of speech, have the most direct nervous connection with the brain, and accordingly their actions are most subject to the influence and control of the will.

The internal viscera, the organs of circulation and nutrition, derive their nerves chiefly from the gangliac system, and their actions are consequently automatic, or not directly subject to the influence of the brain.

Some again, as the organs of respiration, are furnished with nerves from both sources, or derive them partly from the cerebral, and partly from the gangliac system; and their actions are partially under the control of the will, and partially automatic or involuntary.

The identity of the power of motion, whether attended with volition or not, is established, not only by the similarity of the means employed in the production of both, but also in the analogy of the phenomena they present, and the uniformity of the laws by which they are governed.

The limitation of power, too manifest to require illustration, in the organs of voluntary motion, is also observable in those which are involuntary, and is the first point which tends to establish their identity.

The approach of that period at which rest becomes necessary, is not indeed in the latter, as it is in the former, announced by the sensation we call fatigue; because their nerves, which, as just stated, are derived chiefly from the gangliac system, are not so well calculated to awaken mental perception. Those, however, which have cerebral nerves, do

excite perception in the mind after a certain period of action; thus hunger is the perception of the changes going on in the stomach. But where this sensation is wanting, there are other indications that these organs undergo similar changes during exertion, and equally have their powers of action limited by the nature of this faculty, and the physical means instrumental to its support.

The circumstances that chiefly denote this limitation of their power, are the change of function they regularly experience, and the derangement that is liable to ensue if they are compelled to make a more than ordinary exertion, or to continue their efforts for a greater length of time than usual; as the following instances may serve to illustrate.

The blood vessels shew a state of relaxation, in the retardation of blood, and the swelling of the lower extremities, towards evening, in persons of delicate constitution. As the column of blood bears most on the extremities, it is here that its pressure is first felt, and here that the vessels are soonest overpowered by it. The heart shews its susceptibility of fatigue when fainting occurs, from long standing in the erect posture, without the aid of motion to keep up circulation in the extreme vessels. The stomach is fatigued by long continued efforts of vomiting; painful sensation attends it, and the powers of digestion are impaired for a time subsequent to this exertion. The exhibition of an active purgative exhausts, in the same way, the power of the intestines, and a degree of constipation usually prevails for a short time after its operation; while the continued use of active purgatives is well known to bring on habitual torpor in the bowels. The urinary bladder, if oppressed by long retention of urine, loses its power of contraction, and strangury ensues. The rectum, in the same way, loses its contractility from long retention and immoderate accumulation of fæces; and obstinate constipation is the result.

The capillary vessels shew the limited extent of their power in a great variety of instances, always by change of function in the organ to which they belong. The cold fit of fever, during which an unusual contraction prevails throughout the

capillary system, is followed by a proportionate relaxation and over-distension of those vessels in the hot fit. On the same principle, the more transient constriction of the superficial vessels causing the paleness of fear, is succeeded by an increase of heat and redness, indicating subsequent relaxation, and fulness of vessels in the face, and over the surface of the body. The thin watery secretion from the nose, on exposure to severe cold, denoting increased contraction in the secreting vessels, is followed by a dryness and sense of heat in the part, denoting subsequent relaxation and distension of these vessels. Suppressed secretion of urine in hysteria, originating often in the kidneys, and not in the bladder, as proved by the fruitless introduction of the catheter, usually terminates in a secretion remarkably copious. Inordinate or long continued contraction of the exhalents of the cellular membrane, from exposure to cold and damp, is not unfrequently the cause of dropsy in the lower extremities, denoting loss of tone, and consequent relaxation of these vessels, terminating in serous effusion.

In short, the instances are innumerable which might be adduced to prove the universality of this law in the animal economy. Many of the most interesting phenomena of our nature, which have hitherto baffled the attempts of physiologists to account for them, will hereafter be proved to take their origin in this general principle; such as the periodical sensations of hunger and thirst, and the diurnal revolutions of sleep and waking, with all their attendant circumstances.

Further, it will not only be seen, that involuntary, as well as voluntary organs, have their powers of action limited, requiring and experiencing a degree of rest proportionate to that of their previous exertion; but it will also be shewn, that the same fluctuations of power, or successive stages of action, accompany exertion in both; which further establishes the identity of this power under both its modifications.

For instance, it has been remarked by Haller, Hunter, Whytt, Bichât, and others, that the pulse is commonly somewhat slow and languid in the morning; but becomes fuller and stronger towards mid-day; is more quick and irritable towards evening, the period of febrile exacerbation in

invalids; and, at length, full and slow circulation succeeds, denoting spontaneous relaxation of the vessels, as sleep approaches. The same fluctuations will also be traced through the organs of digestion; and we shall thus be enabled to explain why we are prompted, at stated periods, to relieve uneasy sensation in one organ by taking food, and in others by evacuating their contents.

But these points would require more ample discussion than our present limits will allow; and the arguments already adduced are sufficient to establish the unity of the motive power under both its modifications, and the subjection of both to the same general laws,

The next principle that demands our attention, is one still more extensive in its influence, equally applying to the organs of sensation and to those of motion. It regards the connection that prevails between the vital properties and the state of circulation.

The sentient faculty, as we have formerly seen, varies in different parts of the body at the same time, and in the same part at different times; so also does the motive power; and the relation which the former was shewn to bear to the state of circulation, is equally true with regard to the latter.

The most ample supply of red blood is met with in those parts most eminently endowed with the sentient faculty; and, in like manner, those parts of the muscular system most conspicuous for mobility, are most abundantly supplied with the same fluid.

Thus, the organs of animal life or voluntary motion, as the muscles of the limbs and trunk of the body, those of the neck, face and organs of speech, are of a florid red, and amply provided with vessels carrying arterial blood.

It is true, indeed, that the red colour is regarded by Bichât and others, as not arising from the blood that circulates in the extreme branches of the capillary vessels, but from a colouring matter actually combined with the muscular fibre by the process of nutrition, forming part of its substance.

The arguments, however, in favour of this view, are not very conclusive; for the easy separation of this coloured mat-

ter, by mere washing, rather negatives than confirms the idea of an intimate union, which it is conceived to support. At all events, the colour is an indication of the abundant supply of red blood, and of the complete manner in which it penetrates the muscular fibre, to become thus intimately combined with it.

Bichât not only states that this part of the animal economy has the most ample supply of red blood, but also that the red colour is most florid in those parts where the muscular energy is the greatest. And he further observes, that the muscles fade and become paler at that period of life when the muscular vigour begins to decline.

In the organs of automatic life, or the involuntary muscles, which have for the most part a smaller share of mobility, or a more limited range of action, the moving fibre is generally found white and colourless.

Thus the fibres of the stomach, intestines, and bladder, are for the most part colourless; and those involuntary organs which are exceptions in point of colour, are exceptions also in their mode of action, approximating more to the sudden and energetic contractions of the voluntary organs; as is the case with the heart and the diaphragm,

Here again, it is true, the opinion of Bichât may be advanced as an objection, who affirms that in some cases the involuntary receive more arterial blood than the voluntary muscles; and cites the numerous branches which the mesenteric artery sends to the intestines, as an example. But he afterwards admits that this appearance is to a certain extent illusory, as most of these branches only penetrate the coat of the intestine, to supply the mucous membrane within it. Now, it is not the number of vessels passing through, but the minute branches pervading and blending with the substance of the fibre that is here alluded to; and this is evidently the greatest in those parts where the colour is most conspicuous.

But the connection between the state of circulation and the muscular mobility, is rendered still more evident in the occasional fluctuations which the mobility is found to undergo; the power of motion, like the faculty of sensation, not only

varying in different parts, but also in the same part at different times; every change in the state of circulation producing a correspondent change in the degree of mobility, which increases as circulation in the capillary system increases, and diminishes as circulation diminishes.

The following instances may serve to illustrate the effects of impaired circulation, or diminished afflux of red blood to the capillary vessels of the moving organs.

Mere inaction, suffering the circulation to languish, frequently produces a kind of nervous tremor, resembling, and often ascribed to the effects of external cold. Extreme cold, which obstructs circulation, and thus impairs the faculty of feeling, also impedes the power of motion; hence the immobility, the tremors, and temporary paralysis, with which the limbs are affected when exposed to its influence. The constriction of the capillaries, produced by certain mental emotions, as fear, and denoted by the paleness and diminished temperature of the surface, is also productive of the same paralytic tremblings and transient loss of power in the limbs. The cold fit of an ague, which also retards circulation, and impedes the afflux of arterial blood to the capillary vessels, is likewise attended with the same numbness, tremors, and impaired mobility in the muscles. The shrinking of the capillaries attending sea-sickness, also causes a diminution of muscular energy, or an aversion to motion, noticed by every one who has experienced it. The weakness and immobility that result from other excessive evacuations, as hœmorrhage, violent purging, &c. equally arise from want of circulation in the capillary vessels, and subside as soon as circulation is restored. In some cases of actual paralysis, where the muscles themselves are the seat of the morbid change, want of circulation still appears to be the immediate cause of loss of power; and accordingly the means of restoration are all directed to the renewal of active circulation in the muscles. There are also forms of paralysis in which the sensorium, and not the moving organ, appears to be the seat of the morbid change; but here likewise want of circulation is the most probable cause of the diminution of power,

and serous effusion only a concomitant circumstance, otherwise paralysis should always accompany water in the head. In short, every cause that diminishes circulation in the capillary vessels, impairs the vital powers of the part in which this change occurs; and the muscular system, in common with others, is subject to this law.

On the other hand, whatever increases circulation, or determines blood more freely to the muscular system, is productive of a temporary augmentation of mobility, as the following instances will serve to illustrate.

When mere inaction, suffering circulation to languish, has impaired the powers of action, they are quickly restored by bodily exertion, which renews active circulation. On the same principle, the activity increases for a time, with increasing circulation, as we grow warm with action, And when the circulation is most active, before the sense of fatigue approaches, then the tendency to spasmodic contraction is also most prevalent, or the mobility greatest. When, on the other hand, the activity begins to decline, and the muscles acquire a rigid firmness, from permanent contraction or tonic spasm; then the circulation appears likewise to be impeded, the capillary vessels also partaking of the spastic state, and the limbs become cold and benumbed as well as stiff. It is now that frictions, fomentations, and warm bath, relax these vessels, and renew the powers of action, by restoring circulation. It is now that a cordial taken into the stomach renews the activity, by relaxing the constricted vessels, and diffusing a general warmth through the whole body. The subinflammatory state of the muscles consequent to over-exertion, also exhibits an inordinate degree of mobility in the moving fibre, arising from morbid circulation in the capillary vessels, which are manifestly relaxed and over-distended in inflammation; this over-distension being consequent to their previous contraction. The increased afflux of red blood attendant upon this relaxed state, occasioning a morbid increase of mobility, renders every effort of contraction inordinate, spasmodic, and painful.

This morbidly increased irritability, proceeding from aug-

mented afflux of red blood to the muscular system, gives rise to many of the most important phenomena of disease; and the knowledge of this principle affords a rational explanation of the relief obtained, in diminishing morbid irritability, by such means as tend to derive blood from the part inflamed, and allay increased circulation. In illustration of this principle, the following instances may be adduced.

The painful mobility, or spasmodic tendency of the muscles under inflammatory circulation, is the chief cause of the pain attending rheumatic affections. This occasions the pain that is felt at their origin and insertion, from stretching of the tendons, when the muscles, owing to their inordinate mobility, are thrown into spasmodic and painful contraction, upon the slightest effort to move. The acute pain in the side, from every full inspiration in pleurodyne or rheumatic inflammation of the intercostal muscles, which is often mistaken for pleurisy, is produced in this way, from the spasmodic contraction of the muscles, stretching their tendinous insertions between the ribs. The acute pain in the back, termed lumbago, proceeds from the same cause.

In parts less capable than voluntary organs are, of awakening mental perception, this increase of mobility commonly shews itself in the derangement of function it occasions.

Thus the spasmodic breathing and sense of suffocation in asthma, denote inordinate mobility, from increased circulation in the muscles of the bronchiæ and trachæa. The convulsive cough in pertussis may be connected with an increased mobility, from altered circulation in some other part of the respiratory organs. The distressing hiccough that prevails in inflammatory affections of the diaphragm, evidently depends upon morbid irritability, from increased circulation in that organ. The violent palpitation, with frequent and irregular pulse, in certain affections of the heart, arise from increased mobility in this organ, produced by augmented afflux of blood to the coronary system. The constant vomiting that attends inflammation of the stomach, the tormina and tenesmus that prevail in inflammatory affections of the intestines, shew the same increase of mobility attendant upon morbid circulation

in the organs of digestion. Frequent micturition indicates this change in an inflammatory state of the urinary bladder. And the spasmodic contractions of the womb, liable to occur from the sudden suppression of natural evacuations, denotes the same painful mobility, from increased circulation in the uterine organs.

In short, increase of mobility will be uniformly found to attend increase of circulation in the moving organs, both in the healthy and morbid states; the motive power, as well as the sentient faculty, bearing always, within certain limits, relation to the quantity of arterial blood circulating in the minute or capillary vessels of the muscular fibre.

The various modification of the moving power, as connected with peculiarity of structure in the organ; and the share which this cause appears to have in determining the degree of mobility peculiar to each, will be reserved for future consideration.

Art. II. *On the Heat evolved during the Coagulation of Blood. By* J. Davy, *M. D. F. R. S.*

Whether any heat is evolved during the coagulation of blood, is a question which has received opposite answers from different enquirers.

My friend, Dr. Gordon, is decidedly of opinion, that the phenomenon alluded to, is attended with a considerable elevation of temperature, amounting even to several degrees.

This opinion of his, I ventured to controvert, in my Inaugural Dissertation, published about two years ago. And Dr. Gordon did me the honour of replying to my remarks, in a paper published about eighteen months since, in Dr. Thomson's Annals, in which he maintains his former doctrine.

At present it is not my object to criticise his essay, but to offer some additional facts relating to the subject under dispute, which I had an opportunity of collecting on my voyage

to this place, in my way to India. My experiments were made on the blood of the turtle and shark, which last is extremely well adapted to the purpose, as its temperature approaches nearly that of the atmosphere; and on the blood also of sheep.

On the 15th of March, when our ship was in latitude 4° 9′ N. and longitude 19° 15′ W. by chronometer, at sun-set, a large shark was taken by means of a harpoon. As soon as it was brought on deck, whilst it was still alive, it was cut in two. The blood flowing in the great dorsal vein was 82°;* the surrounding thick muscles were 82,5°; the water of the sea was 80,5°, and the air 79°. Some of the blood was collected in a glass. In about two minutes it had firmly coagulated. During the whole time I watched the Thermometer immersed in it. The mercury sunk from 81,5° to 81°, and did not rise at the instant that the coagulation commenced, nor did it remain stationary whilst the coagulation was going on, but continued gradually sinking.

The day following another shark was taken. The same experiment was made with the blood, and a similar result was obtained.

On the 23d of March, when we were in latitude 2° 29′ S. and in longitude 24° 30′ W. a large turtle was killed, which had been caught about three weeks before, at the island of Ascension. The air at the time was 79°. The blood of the turtle flowing from the carotids was 91°. When collected in a glass it was 88,5°. The Thermometer placed in the midst of it, immediately began to fall, and continued falling gradually, without any sensible interruption, whilst the blood was coagulating.

Since I have been at Cape Town, I have repeated my experiments on the blood of sheep. To enter into any details of them would be superfluous, since the results they afforded

* This result is an additional evidence that venous blood is of a lower temperature than arterial; a circumstance which I have endeavoured to prove by numerous observations contained in the Thesis already alluded to.

agreed perfectly with those already described. The air being about 60°, and the blood when drawn about 100°, it continued cooling whilst its coagulation was going on, so that when the coagulum had formed, its temperature was diminished, in between two and three minutes, about one degree and a half."

From these experiments, the obvious, and it appears to me, the unavoidable conclusion is, that which I had before adopted in my Thesis, and which had been first drawn by Mr. Hunter, viz.—"That during the coagulation of blood, there is no sensible evolution of heat."

It now only remains for me to reconcile the fact, (if I may venture to call it by that name), with the well established principle, that change of temperature is the necessary consequence of the change of form of bodies in general; and to suggest a reason for the difference of Dr. Gordon's and my own results.

To accomplish the first, there is little difficulty; and the explanation which I proposed in my Thesis, I shall again offer, as it seems to me quite adequate to the purpose.

Since, during the coagulation of blood, a part of it passes from the liquid into the solid state, there should be, according to theory, some increase of temperature. But since this liquid part, the fibrine, which becomes solid, is so small as to amount only to about $\frac{1}{50}$ of the whole quantity by weight; and since the coagulation is not an instantaneous, but a slow and gradual effect, it appears to me as necessarily to follow, that the heat produced must be too slight to affect sensibly the Thermometer. This granted, which may be proved to demonstration, the anomaly vanishes,—this fact no longer opposes the general principle.

The difference between the results of Dr. Gordon's experiments and my own, has arisen perhaps from the different modes in which our experiments were made. Dr. Gordon, I think, kept the bulb of his Thermometer near the bottom of the vessel containing the blood, and when this fluid began to coagulate towards the surface, he drew the instrument up. On the contrary, in all the experiments I have detailed in this paper, the Thermometer was not allowed to remain stationary;

it was gently moved from one part to another, so that the whole might be kept of the same temperature till the coagulation commenced: for when the blood is viscid, and the vessel deep, the surface on the part last drawn is warmer than that below, and when shallow, the bottom is warmest, as I have frequently observed in my experiments, and as I have remarked in my Thesis, as a source of inaccurate observation.

I could wish to enter more into detail upon the subject; but at this distance from Europe, and consequently from every scientific journal and scientific work, it is out of my power. To Dr. Gordon's well-known candour and liberality of mind I must trust for pardon, for any oversight I may have committed in the consideration of his paper. I am, however, confident, that if Dr. Gordon will repeat the experiments I have described, he will obtain the same results, and be satisfied with Mr. Hunter's original conclusion.

Cape of Good Hope,
May 24th 1816.

Art. III. *An Account of an atmospheric Electrometer. By* Francis Ronalds, *Esq.*

Although atmospheric electricity, from the period of its first discovery, has always been esteemed an important subject of inquiry, and has been the object of much diligent and valuable investigation, it is regretted that a register of careful observations upon it, do not accompany those made in various places, on the pressure, temperature, humidity, &c. of the atmosphere.

The difficulty, if not the impossibility of constructing a correct atmospherical electrometer, and the great inconvenience attendant on the use of the least objectionable kind of instrument, (which perhaps is the "exploring wire" of Father Beccaria), are no doubt the causes of this omission.

The known difficulty seems to be that of preserving the glass supports or insulators of the wires or rods in such a state, that as far as they are concerned in insulating them, they may do so uniformly; but no attempts to effect this object have hitherto succeeded; probably because the deposition of moisture upon them, from the surrounding air, has not been totally prevented. Mr. Read imagined, that if his insulators could be constantly kept in "due temperature," his rod would be always electrified; but he feared, that as this could only be accomplished with the aid of common fire, it would be very difficult, in so large an apparatus, to apply neither too much nor too little. In the apparatus described below, the temperature of the insulator may be (constantly, or whenever an observation is made) raised a little higher than the surrounding air; and consequently it seems reasonable to conclude, that the deposition of moisture on its surface is extremely small, and unappreciable by its conducting power.

That the difficulty is thus obviated in a great measure, at least is evident, by comparing it with those kinds of insulators which are not warmed; but it would be going too far to say, that glass or any other substance, whose temperature is raised ever so little, is not thereby rendered more conducting. One or two other slight improvements on atmospheric electrometers are attempted, and the advantages of several different kinds are combined, so as to render it convenient and applicable to general use. But Mr. Ronayne's simple method, wherein no insulation is required, would no doubt be by far the most satisfactory, if it could be adapted to small intensities.

ABCD (Plate VI,) is the front view of a strong box, standing on four legs, and provided with a glass door. E is the glass support, which perforates the bottom of the box, and also the piece of wood F. The sides of these perforations are lined with strong leather. GGG are bolts, which also pass through the bottom of the box and the piece F, and have nuts, by means of which, and in consequence of the conical figure of the glass, the support is firmly secured in its position, without danger of being broken. That part of the support is hollow, which is marked

with dotted lines, the thickness of glass is about a quarter of an inch at the opening, and the upper part is covered with sealing wax. Beneath the support is a small spirit lamp H, protected from wind by the chimney I, in which only one small thread of cotton is used, to convey spirit to the flame, and it is only lighted when my hygrometer stands beyond 50°. The upper end of the support is furnished with a strong brass socket, to receive the brass stem K, which passes through an aperture of three inches diameter in the top of the box, and to which is attached the ball L; this is pierced to receive the lower joint of a long bamboo fishing rod M, which inclines at an angle of about 45° to the support. The upper joints are covered with foil. The strong wire N passes through an aperture of two inches in the partition O, and carries a pair of forceps, and gold leaf electrometer P. Opposite to the end of this wire, is seen the end of another wire Q, which screws very exactly through the side of the box, and, by means of the milled head, may be adjusted to any required distance from the wire N. The chain R forms a metallic communication between the wire Q and the earth, so that a Discharging Electrometer is thus provided, to measure correctly the length of sparks, and to guard against the effects of violent discharges. Slips of tin foil are pasted upon the side of the box, and of the partition opposite the gold leaves. On the back of the box, at the same height as the lower ends of the gold leaves, is pasted an arc of paper, divided into twenty parts, not equal, but according to the method adopted by Saussure, (Voyages, Tom. 2, P. 204); and another arc, divided into twenty corresponding parts, is pasted on the glass front of the box, exactly opposite to the former, so that the exact degree of electrical tension is ascertained, by bringing the eye into a line with one of the gold leaves, and the two opposite divisions of the arcs.

A pair of very small balls, turned from box-wood charcoal, are suspended from a hook S, at the end of the fishing rod, by the finest silver wire, six inches long, or, in lieu of them, the electrometer Fig. 2, which serves to note the higher intensities, such as of rain, heavy clouds, hail, snow, &c. which,

in an open situation, being so great as to destroy the gold leaves, they can be easily removed.

The apparatus, as represented in the figure, being placed upon a table, in the highest room of a house, and the fishing rod thrust out of the window, is in a proper state for examining the usual atmospheric electricity of serene weather. By withdrawing the rod and stem MK, and closing the aperture in the top of the box with a proper cover, the interior can be preserved from dust, and by the handle T, can be removed to any new position. If it is used in the open air, the rod can be placed vertically in the socket, without the stem K; but in this case, the gold leaves are apt to be a little agitated by wind, if it should be strong, and the charcoal balls may be hung on the wire N in their stead. Sign. Beccaria took particular notice of the "frequency" of electric signs in his wire, or the rates of time at which fresh signs arose, after he had touched it, which, as they are proportional to the degree of atmospheric moisture, he very justly considered deserving of peculiar attention. It is principally for this purpose that fine silver wire and hard charcoal balls are perhaps preferable materials for electrometers, to threads of any kind, and pith or cork balls, since the former, by becoming very dry sometimes, and then not conducting equally well, diverge more slowly than they ought, and are consequently equivocal indicators of this property of frequency; and the practice which has been recommended by some electricians, of moistening them with salt water, in order to render them better conductors, not only makes them objectionable on account of their liability to twist, bend, and shorten, but because their weight is not immaterially varied by this process. Pith or cork balls, when not new, are apt to stick. Fig. 3 is a convenient instrument to be employed in the construction of electrometers of silver wire and charcoal balls, which is, as Mr. Cavallo observes of those made with cork balls and silver wire, is very difficult in the usual way. ABCD is a bow of steel wire, having a hook at each extremity. After the ball has been threaded on the silver wire, and rings formed at each end, it is *very gently* stretched in this bow, by passing the

hooks through the rings, and shoving it forward, with the thumb placed against the end of the tongue, near the handle, which tongue is thus made to open wide, by pressing the screw E on each side. Then the screw is turned a little farther into the piece F, in order to secure it firmly in its place. The fine wire is now carefully laid upon a piece of iron, heated a little below redness, which renders it perfectly straight, and it may be removed from the bow, and hung upon one of the rings of the piece of brass G.

Art. IV. *An account of the Shepherds of the Landes, in the South of France. In a letter to the Editor, from* Thomas Maynard, *Esq.*

London, November 12th 1816.

My Dear Sir,

The accompanying figure (see Plate VII.) represents a shepherd of the Landes, or desart in the South of France. This tract of country lies between the mouths of the Adour and the Gironde, along the sea coast, and, according to tradition, was once the bed of the sea itself, which flowed in as far as Dax.* Through this district the guards marched from Bayonne, at the conclusion of the war in June 1814, to embark at Bourdeaux. This afforded us an opportunity of seeing a country seldom visited by travellers. It is a bed of sand, flat, in the strictest sense of the word, and abounding with extensive pine woods. These woods afford turpentine, resin, and charcoal, for trade, as well as a sort of candles, used by the peasantry, made of yarn dipt in the turpentine. The road is through the sand, unaltered by art, except where it is so loose

* This is not the only change. The river Adour also has altered its course, the old bed of the river is marked by an extensive lake and morass to the north of the present course, and along the high road to Dax.

and deep as to require the trunks of the fir trees to be laid across to give it firmness. The villages and hamlets stand on spots of fertile ground, scattered like islands among the sands. The appearance of a corn field on each side of the road, fenced by green hedges, a clump of trees at a little distance, and the spire of a rustic church tapering from among them, gave notice of our approach to an inhabited spot. On entering the villages, we found neat white cottages, scattered along a bit of green, surrounded by well cultivated gardens and orchards, and shaded by fine old oaks and walnuts. Through the centre of the village, a brook of the clearest water was always seen running amongst meadows and hay fields, and forming a most grateful contrast to the heat and dust of the sandy road. It was between the villages of Castel and La Buharre that we first saw these shepherds, mounted on stilts, and striding, like storks, along the flat. These stilts raise them from three to five feet: the foot rests on a surface, adapted to its sole, carved out of the solid wood; a flat part, shaped to the outside of the leg, and reaching to below the bend of the knee, is strapped round the calf and ankle. The foot is covered by a piece of raw sheep's hide. In these stilts they move with perfect freedom, and astonishing rapidity; and they have their balance so completely, that they run, jump, stoop, and even dance, with ease and safety. We made them run races for a piece of money, put on a stone on the ground, to which they pounced down with surprising quickness. They cannot stand quite still without the aid of a long staff, which they always carry in their hands. This guards them against any accidental trip, and when they wish to be at rest, forms a third leg, that keeps them steady. The habit of using the stilts is acquired early, and it appeared that the smaller the boy was, the longer it was necessary to have his stilts. By means of these odd additions to the natural leg, the feet are kept out of the water, which lies deep during winter on the sands, and from the heated sand during the summer: in addition to which, the sphere of vision over so perfect a flat is materially increased by the elevation, and the shepherd can see his sheep much farther on stilts than he

could from the ground. This department of France is little known, and if what I have here related be as new to your readers as it was to me at the time I first saw them, this description may possibly afford them some amusement.

I remain, Dear Sir, &c. &c.

THOs. MAYNARD.

ART. V. *Traité de Chimie, élémentaire, théorique, et pratique, par* L. I. THENARD, *&c. &c. &c.* 4 *Tomes, Paris,* 1813, 1814 1815, 1816.

SINCE the publication of the voluminous and inaccurate "Système des Connoissances Chimiques" of M. Fourcroy, no systematic work on Chemical Philosophy, has appeared in France. We are glad, therefore, to direct the attention of our readers to the present work of M. Thenard, hitherto best known as the coadjutor of M. Gay Lussac, to whom he very unaffectedly dedicates his book.

The works of Drs. Thomson and Murray, are regarded as the standard chemical systems of this country—the historical accuracy and abundant references of the former, rendered it most valuable to the experienced chemist, while the Dædalian perplexity of its arrangement, made it quite inaccessible to the student. Dr. Murray's work, less copious but more clear, was advantageously resorted to by the beginner, while its perspicuous and elegant style rendered it at least agreeable to the proficient. But these works may be regarded as in a great measure obsolete. Since the authors arranged their materials, electricity has acquired new importance; the alcalis and earths, and the boracic acid, have been decomposed, and have afforded new combustible principles, a new supporter of combustion has been discovered, our views respecting the constitution of acids have been new modelled, and even the fundamental doctrines of chemistry have been modified by the discovery of the law of definite proportions. Under these

circumstances, a System of Chemistry from the pen of one who has been actively engaged in promoting the modern improvements of the science, will be eagerly and scrupulously examined by his scientific brethren.

Of the four volumes of this work, the two first relate to inorganic substances—the third to organic bodies, and the fourth to chemical analysis. There is also a copious index, not common in French works: an alphabetic description of chemical apparatus: and thirty-two plates of retorts, receivers, funnels, furnaces, and the like, of which one-fourth the number would have been more than sufficient. They are, however, neatly, clearly, and economically executed.

The first chapter is entitled, "*Notions sur la Nature des Corps, et sur la Force qui unit leurs Parties constituentes.*" It enters immediately, but superficially, upon the important subject of attraction, which is considered as influencing the cohæsion and form of bodies, and afterwards, under the title *Affinity*, as relating to their composition.

Affinity is modified, 1st, by the the relative quantities of the combining bodies; thus, if we suppose three compounds, the first consisting of one proportion of A + 1 B, the second 1 A + 2 B, and the third, 1 A + 3 B, one proportion of B will more easily be separated from A, in the third than in the second, and in the second than in the first case.

2. By their previous states of combination.

3. By cohæsion.

4. By caloric.

5. By the electrical states of the bodies.

6. By specific gravity. This we do not quite understand, as applied to chemical combinations. "When the specific gravity of two bodies differs, they have a tendency to separate, and if their mutual affinity is weak, they cannot combine; *as oil and water.*"

7. By pressure. The solution of gasses by fluids—and the retention of carbonic acid by lime at high temperatures, are here adverted to.

The *laws* of combination are next considered. There are two distinct kinds of combination. 1. Those bodies which

exert very powerful mutual attractions combine only in certain proportions; and if two bodies A and B unite in two proportions, so as to form the bodies C and D, the proportion of B in C will be to that of B in D as 1 to 2, or 2 to 3, or some similar simple ratio.

In these cases of combination, the properties of the compound are much at variance with those of its constituents—common salt results from the union of two caustic bodies—sulphur, by combining with one of the elements of the atmosphere, produces a compound having an acrid smell and taste.

2. In the second cases of combination, the bodies have less attraction for each other, and they combine within certain limits, in all proportions; the properties of the compound too, are little different from those of its constituents. Such are the solutions of salt and of sugar in water.

Some of those doctrines of Berthollet which have been so well refuted by Davy, are next advanced; but as the author reserves their discussion for a future part of his work, we shall gladly follow his example, and proceed to the second Chapter, which treats of *imponderable substances*, which, we are told, are four in number.—1. The fluid of heat, or caloric.—2. The fluid of light; 3. The electric fluid; 4. The magnetic fluid.

We should have expected that the author would have here entered into those interesting discussions concerning the materiality of these agents, which engaged the attention of Bacon and of Newton, and that the evidences on both sides of the question would have been brought forward and compared. The question is concisely eluded in the following paragraph. "Leur impondérabilité rend leur existence douteuse; quoi qu'il en soit, nous en parlerons comme s'ils étaient des corps réels, mais nous n'affirmerons rien à cet égard, et nons préférons cette hypothèse à toute autre, parce qu'elle est plus commode pour exposer les faits."

In this we are by no means of M. Thenard's way of thinking; for although some of the phænomena of heat may be

most easily explained upon the *material hypothesis*, others are more consistent with that view of the subject which consider *motion* as their immediate cause.

Nothing is more repugnant to the progress of philosophy than this hasty assumption of easy hypotheses; it makes us believe ourselves wiser than we are; and tends to the substitution of words for things.

M. Thenard commences the subject of heat, with an account of the phenomena of radiation, in which the admirable researches of Leslie and Rumford are clearly though briefly detailed. The ensuing sections treat of the equilibrium of heat, and of its passage in solids, fluids, and gases. Water is a very bad conductor of heat, "hence the surface of the sea and lakes is in a hot summer much warmer than the deeper parts." This is an unhappy illustration; the warm water being specifically lighter than the inferior cold water, floats upon its surface. In this part of his work the author is too brief for a systematic writer.

The interesting experiments of Drs. Thomson, Murray, and Hope, on the conducting powers of fluids, are not noticed, and conclusions follow each other without any reference to the experiments which establish them—this is not right in a system of chemistry.

The section which treats of dilatation or expansion is more full. The important discovery of Gay Lussac and Dalton respecting the similar expansion of different gases and vapours for equal increments of heat, is detailed at length. Thermometers are next described, and a long account is given of Wedgwood's pyrometer. The author does not seem aware that Sir James Hall's researches have invalidated all that has been done with this instrument, simply by showing that the pieces of clay contract as much when submitted for a long time to a red heat, as when exposed for a shorter time to a white heat. The observations on the construction of the mercurial thermometer are minute and correct, and are succeeded by a description of Mr. Leslie's differential thermometer.

In the account of the effects of heat upon the state of bodies, we are told of the experiments of Dalton, Clement Desormes, G. Lussac, Papin, and others; but of Black we hear not a word, though he was doubtless the founder of a beautiful department of philosophy relating to these changes, and his original researches are not merely equally illustrative, but more simple and satisfactory, than those of his favoured successors.

Heat is next considered as effecting decomposition; and the succeeding section relates to contraction by cold; but here we having nothing either new or pertinent.

The merit of shewing that different substances *in the same state,* such as different liquids, gases, and solids, contain different proportions of heat, though of one thermometrical temperature, is given to Dr. Black, though Boerhaave really began the investigation. The section on specific heat is somewhat confused by an unnecessary reference to the different quantities of heat in the same substance in *different states,* which had been before discussed. The modes of ascertaining the specific heat of bodies, by mixing them at different temperatures, and the method suggested by Wilcke and Mr. Leslie of ascertaining their relative rates of cooling when carried from a warm to a cold atmosphere, are scarcely hinted at; but much is said of the calorimeter invented by Lavoisier and La Place, intended to measure the specific heat of different bodies by the different quantities of ice which they are capable of thawing, in a given time—for instance, whilst cooling from the boiling to the freezing point of water. It was the ingenious Wilcke of Stockholm, who first thought of thus ascertaining the specific heat of bodies, but he gave it up on account of various inaccuracies to which it is liable, and which, with many others pointed out by Mr. Wedgwood, (Phil. Trans. vol. 74.) and often witnessed by ourselves, render this calorimeter an inaccurate and unmanageable instrument, and throw the shade of error upon all results obtained by its means. The description and plate of this instrument have been copied from one system of chemistry to another, till we are tired of seeing them—he who will take the trouble of using it,

will find it impossible to get two results alike. It is time that this and other similar pieces of machinery should be left out of systems of chemistry—they only perpetuate error.

An account is subjoined of a new calorimeter, invented by Count Rumford. It consists of a cistern of water through which a tube passes horizontally; to one of its extremities is attached an inverted funnel. The flame of wax, spirit, or other substance, the heating power of which is to be ascertained, is placed under this funnel, and the effect measured by a thermometer immersed in the cooler, or cistern. We have used an apparatus of this kind, but it is worth nothing; for the condensation of water, and the deposition of carbonaceous matter upon the funnel and in the tube, prevent any accuracy of results. M. Thenard next considers the sources of heat—solar and terrestrial. The first paragraph of this section announces Dr. Herschel's discovery of heating rays of less refrangibility than the calorific rays. The second states, that heat is produced by compression; and the third, that it is elicited by combination—here we are referred to a future part of the work, which treats on combustion.

The next section is entitled "du Froid," and the production of cold by the liquefaction of solids, and the evaporation of liquids is mentioned, rather than discussed. Mr. Leslie's beautiful experiment of the freezing of water by accelerating its evaporation in vacuo with the help of a surface of oil of vitriol, is new described. We cannot but think that the whole of this part of the Chapter on caloric, is badly managed: though brief, it is perplexed. Why, for instance, confuse the phenomena of latent, with those of specific heat? or why not notice the production of cold by liquefaction and evaporation when discussing the effects of heat upon the state of bodies, instead of just hinting at them in a section on *cold.* The analytical and synthetical results would thus have been conveniently opposed to, and compared with, each other.

In the article entitled, "Des Propriétés chimiques de la Lumière," we are hastily informed that the violet rays are less capable of producing heat than the red; that Dr. Herschel found the greatest heating power of the spectrum to exist

just out of the red ray; that Scheele ascertained the peculiar *chemical* powers of the violet rays, and that Wollaston, Ritter, and Bockman, discovered the concentration of these rays to exist in the space beyond the violet ray, and entirely out of the calorific spectrum. Something is said about the light of the moon, and the identity of light and heat; and this, really and literally, is all the information which M. Thenard has thought fit to communicate upon the subject of *light*.

But the division of this chapter, relating to electricity, is yet more lamentably brief. Here, if any where, the author should have been copious and minute;—upon this subject the majority of his readers want information, and no chemist, who has aspired to the name of a systematic writer, has hitherto treated it in full: we hoped, therefore, to have found in this work of M. Thenard a general critical view of those doctrines which have of late conferred a new aspect on chemical science, and to have seen those gaps filled up which the less presuming authors of mere elementary works have had some excuse for leaving. The first paragraph on electricity runs nearly as follows.—We know that all bodies contain a certain quantity of electric fluid, which may be regarded as consisting of two different fluids, the one vitreous or positive, the other resinous or negative; that while these two fluids remain combined, no electrical effects are manifested, but whenever either becomes free, it renders itself evident, by communicating the power of attraction and repulsion to the bodies which receive it—they become *electrified*. Two bodies electrified by the same fluid, repel each other; but if one body be charged with the vitreous fluid, and another with the resinous, that is, if they be dissimilarly electrified, they then attract each other. If we now suppose two molecules of a compound, A and B, to be positive and negative, it follows that these molecules might be separated by presenting to them sufficiently energetic electrical powers; that a positive body would repel A and attract B, and that a negative body would attract A and repel B, and consequently effect their separation; provided always the separating powers are greater than those which hold the molecules together.—All this may

be readily allowed, for we do not propose to stop here to ask whether electrical phenomena depend upon one fluid or two fluids, or upon any fluid at all; we grant all the author demands; but we cannot follow him in the next leap at a conclusion. "Telle est précisément la manière d'agir de la pile Voltaique," the theory of which is next explained. We have long considered a satisfactory theory of the Voltaic pile as one of the great desiderata in the higher departments of chemical philosophy. The theory given in the pages before us we consider as by far the best, except indeed, that, by the unfortunate substitution of the word *conductor*, for *imperfect conductor*, the whole is rendered confused, and unless thus corrected, we in vain look for the cause of accumulation in the pile. Nothing is here said of the strange influence of chemical action, in augmenting the quantity of electricity, and the reason assigned for the prodigious augmentation of effect, produced by substituting dilute nitric acid for salt water, in Volta's pile, is, "que parmi les acides, c'était l'acide nitrique qui produisait le plus d'effet, *ou transmettait le plus vite* l'électricité d'un élément à l'autre." The fact is, that the rapidity of transmission here resorted to, is no adequate explanation of the increase of effect. Solution of potash is as good a conductor as solution of nitric acid, and yet it does nothing towards increasing the electrical effects. Chemical action is wanted for this purpose, and where it is intense, as Dr. Wollaston has well shewn, the *quantity* of electricity rendered apparent by a pair of plates that may be dipped into a thimble, is greater than has yet been generated by the most powerful electrical machine, unaided by means of accumulation.

A long account is given of the "Construction d'une pile à plaques de petites dimensions"—and we must again express our regret that the pages here devoted to directions useful only to the carpenter and instrument maker, were not filled with more important matter; that the general laws of electrical action are wholly passed over; that the necessary distinctions between *quantity* and *intensity* are undefined; that De Luc's column, as illustrating the *modus operandi* of the

pile, is unnoticed; and that the important relationship between chemical and electrical changes is scarcely mentioned. In a system of chemistry, all this would have been new ground, and much credit might have been gained by carefully traversing it. This second chapter concludes with a brief section on magnetism, and we take leave of the history of imponderable bodies.

If this system of chemistry be written for the benefit of the student, we consider this part of it as unwarrantably deficient; the clearest notions should be gained of the proportions and powers of matter, or, as our author has it, of the chemistry of imponderable bodies; and to these the pupil's attention should be steadily directed at the outset of his studies; it is here that he must get the light that is to lead him on; we are sorry, therefore, to find the whole dispatched in little more than a hundred pages,

In the third chapter, the subjects of nomenclature and arrangement are treated of. The improvements in the nomenclature of chemistry, devised and executed by the school of which Lavoisier was the head, should always be gratefully acknowledged and remembered; they not only tended to banish the fanciful absurdities of alchemy, but gave a steady and philosophic aspect to the science; and the rapidity with which they were adopted, not merely by the French chemists themselves, but by their less pliant brethren in Germany and in England, was no small proof of their excellence, and of the inconvenience caused by the want of some fixed nomenclatural principles. Like all other extensive innovations, they were carried too far, and deemed too perfect; but these are matters of little import when contrasted with the benefits they produced. Nor has any system of nomenclature been subsequently devised, not liable to similar, and more weighty objections, at least where it relates to compound bodies. The terms *chlorine* and *iodine* are excellent; they refer to inalienable properties of the bodies so called, and can never involve the perplexities which modern discoveries have heaped upon the once unobjectionable term *oxygen*.

In speaking of the arrangement to be adopted in regard to

ponderable bodies, oxygen is placed at the head of the list; it is followed by the simple and compound inflammables, and by the oxides and acids, and their numerous compounds. The operations of metallurgy are considered apart, and followed by the chemistry of the vegetable and animal kingdoms. A general view of the art of chemical analysis completes the work.

The following order is observed in the examination of individual substances.—1. Physical properties. 2. Chemical properties. 3. Different states in which they occur in nature. 4. Method of obtaining them pure. 5. Their composition. 6. Uses. 7. Abridged history of their discovery, &c. Oxygen stands alone as the supporter of combustion, and the author is quite silent concerning the pretensions of chlorine, to rank with oxygen, and to be regarded also as a simple body. It was to be expected that, as Sir H. Davy's Paper upon the nature of the *oxymuriatic acid* was published in 1810, and as Gay Lussac and Thenard had previously cast doubts upon Berthollet's hypothesis respecting its composition, in the 2d volume of the Mémoires d'Arcueil, that something at least would have been here thrown out upon this subject; instead of which, the oxygenated muriatic acid is described afterwards among the "*Corps brulés binaires*," and the muriatic acid is noticed under the improper and hypothetical term of "acide hydro-muriatique," *parceque il contient le quart de son poids d'eau, ou de principes de l'eau.* We hear nothing of *chlorine* till the end of the 4th volume, where, among the "Additions," is an article entitled, "Sur l'explication des phénomènes que présente le gaz oxymuriatique ou le gaz muriatique oxygéné, dans *l'hypothèse* qui consiste à regarder ce gaz comme un corps simple." It seems to us, that the term *hypothesis* should have been applied to that view of the subject which regards oxygen as a component of chlorine, and that the explanation here given, is the simple statement of facts, as founded upon actual experiment and observation. We are tired of hearing persons who ought to know better, assert that *either hypothesis* may be assumed. It is this vacillancy respecting chlorine that has spoiled all that part of

Thenard's book which relates to it; it has broken in upon his general arrangement, which would have been more perfect had he inserted chlorine after oxygen, or even after nitrogen; for, as he and Gay Lussac term its compounds "*Chlorures,*" it is to be presumed, that they regard it as rather belonging to that class—although this notion must have been somewhat shaken by the recently discovered analogies between iodine and chlorine; and given a sketch of Berthollet's *hypothesis* of its nature, among the "addenda" at the end, or what perhaps would have been preferable, said nothing whatever concerning those errors of the French school.

The chapter on oxygen contains a section on combustion, in which the incorrect axiom is held out, that combustion always consists in the combination of the burning body with oxygen, and that the heat and light which result are derived from the gas. To say nothing of the numerous instances of combustion, in which it *cannot be proved* that oxygen is present, this hypothesis does not apply even to those cases where it is; we have no satisfactory explanation, for instance, why hydrogen, which condenses during combustion more oxygen than any other body, does not cause the evolution of $\frac{1}{1000}$ part of the light which is produced by burning phosphorus, though it is itself gaseous. But it would be endless to repeat all that has been said upon this often argued point; we therefore refer our readers to the sensible remarks of Dr. Thomson, (Syst. of Chem. 3d edit. Vol. 1, p. 589); and more especially, to Sir H. Davy's enlightened and unbiassed observations on the subject, (Elem. of Chem. p. 225). "All later researches," he says, "seem to shew that no *peculiar* substance, or form of matter, is necessary for the effect (combustion); that it is a general result of the actions of any substances possessed of strong chemical attractions, or different electrical relations; and that it takes place in all cases in which an intense and violent motion can be conceived to be communicated to the corpuscles of bodies. We have long been surprised at the industry and solicitude with which many of the absurdities and contradictions of the French school of chemistry, (we

speak of it in Lavoisier's time), have been palliated, evaded, and propagated, by men whese scientific character and abilities should have excited them to the nobler endeavour of developing the naked truth, and of freeing facts from the shackles of hypothesis. Too much credit cannot be given to Sir H. Davy, for the manly and impartial tone in which he used to treat this subject in his Lectures in the Royal Institution, and for the calm, though convincing remarks scattered through his "Elements of Chemistry," upon the danger of substituting plausibility for truth, and of thoughtlessly adopting hypotheses which are at variance with the results of experiment.

M. Thenard has again touched upon the theory of combustion, in a subsequent section, on atmospheric air, and has there done some justice to Jean Rey of Perigord, who was the first to demonstrate the influence of the air upon the combustion of metals—a writer whose works have been singularly neglected and unnoticed by those who have aimed at conferring upon Lavoisier the sole merit of conceiving and bringing forth the "new theory of combustion;" but of our illustrious countrymen, Mayow and Hales, no mention is made in the *historique* of this subject.

The simple non-metallic combustibles are discussed in the following order.—1. Hydrogen. 2. Boron. "On ne le connait que depuis 1809 : il a été découvert par M. Gay Lussac et Thenard." This is incorrect; it was discovered by Davy in 1808. (See Phil. Trans. 1808, p. 343.) 3. Carbon. "On ne trouve le carbon pure que dans le diamant"? Newton, in his conjecture concerning the combustibility of the diamond, was anticipated by Boetius de Boot: Boyle too had previously ascertained the fact, and so had the Tuscan philosophers. 4. Phosphorus. 5. Sulphur. "Il est évident que tout le calorique et toute la lumière qui se dégagent dans la combustion du soufre (dans le gaz oxygène) proviennent du gaz oxygène." Yet there is not only no solid formed, but the sulphur becomes gaseous, and the volume of the oxygen remains as at first. 6. Azote. The term *nitrogen* appears preferable. It was not discovered by Lavoisier in 1773, but by Priestley and Rutherford in 1772.

The metals, amounting, according to the author, to 38, occupy the next section; they are subdivided as follows:

A. Metaux présumés.—1. Silicium. 2. Zirconium. 3. Aluminium. 4. Yttrium. 5. Glucinium. 6. Magnesium.

B. Metals which absorb oxygen from the air even at high temperatures, and rapidly decompose water at common temperatures.—1. Calcium. 2. Strontium. 3. Barium. 4. Sodium. 5. Potassium.

C. Metals which absorb oxygen at high temperatures, but which only decompose water at a red heat.—1. Manganese. 2. Zinc. 3. Iron. 4. Tin.

D. Metals which absorb oxygen at high temperatures, but which do not decompose water at any temperature.—1. Arsenic. 2. Molybdenum. 3. Chrome. 4. Tungsten. 5. Columbium. 6. Antimony. 7. Uranium. 8. Cerium. 9. Cobalt. 10. Titanium. 11. Bismuth. 12. Copper. 13. Tellurium. This subdivision is again subdivided into *acidifiable metals,* including the five first; and *oxydable,* including the eight last.

E. Metals which absorb oxygen at certain temperatures only, and which do not decompose water.—1. Nickel. 2. Lead. 3. Mercury. 4. Osmium.

F. Metals which neither absorb oxygen nor decompose water at any temperature.—1. Silver. 2. Palladium. 3. Rhodium. 4. Platinum. 5. Gold. 6. Iridium.

This arrangement of the metals, though one of the best we have met with, would perhaps be improved by inversion. The description of the general properties of the metals is extremely good, but the particular details are deficient, hurried, and ill arranged.

M. Thenard has here fallen into the fault of many chemical writers, who, to accommodate certain whims in regard to arrangement, so dismember the subjects of investigation, as to render it utterly impossible to find any point whence they may be viewed in connected order. If we desire to learn the history of any one of the simple bodies, we are obliged to search for its fragments in every corner of each of the volumes, and to encounter the tiresome operation of putting

them together, which, after all, produces a clumsy and unhandy whole. Let us take one of the metals as an instance. Iron—its physical properties are described at page 242, Vol 1. In the same chapter we are told that it combines with oxygen, and how it may be burned in that gas; but, to learn further the composition and properties of the oxides, reference must be made to Vol. 2, p. 72. The sulphurets are described in Vol. 1, page 376, its alloys at p. 418, its extraction from the ores, very imperfectly given in Vol. 2, p. 703, its distinctive characters in Vol. 4, p. 57, and its salts are most ingeniously scattered throughout all the four volumes, so as considerably to exercise his patience who would endeavour to find them.

Having, then, dismissed these brief prolegomena touching the metals, we come next to the compounds of the simple non-metallic combustibles with the metals. The hydrurets, *borures*, carburets, phosphurets, sulphurets, and alloys, succeed each other; but they would have appeared to much greater advantage under the head of the respective metals. The greatest violence, however, has been done to the "*corps brulés binaires.*" Water, oxide of carbon, and of phosphorus, and the two oxides of nitrogen, are pent up in the first section; and the second contains the acids. It would surely have been more convenient and philosophical, if, in treating of phosphorus in the former part of the work, its oxide, acids, &c. had been there described; and so in regard to the other bodies.

The second volume opens with the history of the metallic oxides; among which, the earths are properly, but ammonia improperly, arranged: the metallic acids are considered apart at the end of this chapter.

The 8th chapter treats of the reciprocal action of the oxides. The hydrates, the combinations of the oxides of the common metals with the alcalis; glass, pottery, earthenware, and cements, here make their appearance.

In the 9th chapter we are informed of the action of the acids upon each other: in the 10th, of the reciprocal action of the oxides upon the acids; among which, the *dilute* acids

are most unconscionably poured in, because they contain water, which is an *oxide of hydrogen.*

The 11th chapter treats of the reciprocal action of the acids and the metallic oxides, and consequently embraces the very important class of metallic salts; and the 12th, and concluding chapter of this part of the work, describes the processes by which the metals are extracted from their ores, and brought to the state in which we meet with them in commerce and the arts.

The observations on the metallic salts, contained in the 11th chapter, are among the most valuable we have met with; indeed, the whole of this part of the work is so well executed, as to make us wonder that the others are faulty as they are. Even here, however, there are some remarks with which we can by no means accord. We should have been better pleased, for instance, to have found the salts of mercury annexed to the section describing the metal and its oxides; to have had the metallic oxide as the basis of the genus; and do not see the weight of the objections to this plan urged by the author, Vol. 2, p. 300. In this part of the work too, there are some well conceived tables—not perhaps very useful, but rather curious, and calculated to expose the general characters of the salts. Such are the tables of the colours of the different salts, of their tastes, of the colours produced in them by sulphuretted hydrogen, of their reduction by the immersion of metals, of the combination of salts with each other, &c. In short, the section of this work, entitled, "Des Sels en général," is a valuable contribution to chemical science; and had not this article already extended to its due boundaries, we should have been inclined to have enlarged our critical observations upon the important doctrines here discussed. "De graves erreurs ont été commises; mais enfin ils ont disparu pour faire place à de grandes vérités: Ces vérités nous ont été enseignées surtout par Lavoisier, Richter, M. Berthollet, M. Davy, et M. Berzelius." In assigning to these exalted names their respective merits, the author tells us, that Lavoisier was the first to shew that a metal never unites to an acid, except in the state of oxide:

that Richter first demonstrated, that when two *neutral* salts decompose each other, the results are always *neutral:* that the different weights of bases which unite to one acid, are in the same ratio as those which unite to other acids, to form other salts; and that in all salts of one genus, and in the same state of saturation, the quantity of oxygen in the oxide is proportionate to the quantity of the acid, and consequently to the quantity of oxygen in the acid.

Berthollet, says M. Thenard, proved that an acid might decompose a saline compound, without having as strong an attraction for the basis of the compound as has the acid with which it was first combined, and consequently that no reliance could be placed upon the usual tables of affinity; that double decomposition is affected by the insolubility of the resulting compounds; and that two saline solutions, which, in a certain state of dilution, are incapable of decomposing each other, acquire that power by concentration, because, in that case, one of the resulting salts can no longer remain dissolved.

Davy has proved that the alcaline and earthy bodies have metallic bases; and their compounds, with the acids, are, therefore, referable to the class of metallic salts.

Berzelius first carefully observed the decomposition of salts by the pile; that the quantity of oxygen in the acid of a salt bore a simple ratio to the quantity of oxygen in the oxide; he has also determined, with almost mathematical precision, the composition of the greater part of the salts. Dulong, Gay Lussac, and Wollaston, are likewise deservedly quoted, as benefactors to this department of chemistry.

The third volume of M. Thenard's work presents a good and useful digest of organic chemistry, vegetable and animal —and the arrangement here, less artificial, is more intelligible than that of the former parts. In the first chapter the elements of vegetable bodies are enumerated with extreme brevity. The second chapter treats, under two sections, of the formation of vegetable bodies; and in the third, their properties are examined. The vegetable acids, and their salts, occupy the first section, which, however, appears objectionable,

because bodies are here brought upon the stage, the sources of which are not as yet laid open. Thus, the production of vinegar might have preceded the account of the acetic acid and acetates, &c. In these acids, however, the relative proportion of oxygen to hydrogen is greater than in water. In the substances of the second section, the relative proportion of oxygen to hydrogen is the same as in water; these are—sugar, *mannite? sweet principle of oils?* asparagine, starch, gum, and wood. The third section embraces the oils, resins, alcohol, and ethers, and some other bodies, marked by excess of hydrogen. The fourth section relates to colouring matters, and their uses; the fifth, to vegeto-animal bodies; and the sixth, to substances imperfectly examined; among which we were startled at meeting with extractive matter and tannin; the latter surely deserves to be acknowledged as a legitimate proximate principle of vegetables—its existence cannot be called "*douteuse.*"

The different parts of vegetables are chemically described in the fourth chapter—the pith, juices, woods, barks, roots, leaves, &c.; and the fifth relates to the products of fermentation—to coal, and bitumens. The animal bodies are subdivided into—1. Substances "ni acides, ni grasses." 2. Acids with double and triple radicles. 3. Fatty substances. 4. Saline and earthy bodies. Under the heads of digestion, circulation, and respiration, the chyle and blood are spoken of, and the other animal principles are enumerated as secretions.

Unpardonable brevity pervades this part of the work; indeed M. Thenard has throughout slurred over chemical physiology in a slovenly way. We turned with some eagerness to the "Theory of Animal Heat," (Vol. iii. p. 525), and are only told, that as the blood is always forming new products, and entering into new combinations, heat ought to be evolved: and that M. De Laroche has made experiments to prove, that the temperature of warm blooded animals is influenced by that of the surrounding air. Although we are by no means anxious for too much bare physiology in a chemical treatise, it is pretty obvious that a slight notice of

Mr. Brodie's curious investigations, concerning the influence of the brain on animal heat, would have been much more in place, than the bald assertions contained in a disputed thesis of M. De Laroche.

The fourth volume contains an essay on chemical analysis; it is short, but the subject is so important, as to merit longer notice than we can now afford. An examination, therefore, of this, which is indeed an independent treatise, may be deferred till we can give it more room in another Number of the Journal.

Though we have met with much that is clever and well managed in these volumes of M. Thenard's treatise, we must be allowed to grumble a little, at the faults of omission and commission, of which we have presented a few to our readers. It is a work certainly inferior to the system of Murray, and much below the elaborate production of Dr. Thomson, of which we hope soon to see a new edition, loudly demanded, from the recent progress of chemistry. We are glad too, of this opportunity, of expressing our unqualified approbation of Dr. Henry's "Elements," a book not less important for the copious and well arranged facts which it contains, than for the candour and clearness of the narrative.

Art. VI. *Of the Ergot or Clavus in Corn, known among Farmers by the name of the Spur. From an Essay on the genus Sclerotium, by Monsr. De* Candolle, *in the Mémoires du Muséum d'Histoire Naturelle, Paris.*

The above-mentioned essay is of considerable interest, as containing the probable discovery of the origin and nature of a disease in corn-plants, by which the produce of one of their most useful species is often, in many districts of Europe, rendered dangerous to the health of the inhabitants, of whose

food it forms the principal portion. To know the origin and nature of a disease, independent of the acquisition to knowledge, and gratification of curiosity, is important, as an advance towards the discovery of the remedy. The scientific denomination of that which forms the subject of this extract, is *Clavus*, the vernacular one in France, Ergot, with us, it is called the Spur in Rye and Barley. Its nature had been long a research among naturalists, but still remained the problem which Monsr. De Candolle has endeavoured to solve. He thinks he has proved it, like the different sorts of Smut and Blight, to arise from a Mushroom of the genus SCLEROTIUM, and ranks it by the specific name of *S. Clavus*. The proofs are drawn principally from analogy, the very low state of organization in the members of the genus to which he presumes it to belong, or perhaps our present imperfect acquaintance with them, seeming scarcely to admit of any other. Their organs of reproduction are still a question.

The *Sclerotiums*, of which 30 species have been enumerated, are small solid fungous bodies, generally of a rounded, oval, or elongated form, but not very constant to any; their interior substance is hard, sometimes a little fleshy, sometimes almost as hard as wood, always white or inclining to white, entirely free from the veins which give the marbled appearance we observe in the flesh of truffles; the outer skin is smooth in an early stage, often a little wrinkled in a more advanced one, usually black, sometimes of a dingy purple, seldom yellow or white, and covered in several species by a peculiar kind of dust or efflorescence, of the same colour as the surface.

Contrary to the opinion of Messrs. Tode and Persoon, *Sclerotium* is ranked, by M. De Candolle, between *Elvella* and *Clavaria*, as belonging to that groupe of Mushrooms which have external organs of reproduction, *(spori)*, and not internal ones, as in the truffles, to which it had been before approximated. The differences from *Clavaria* are so slight, as not to be easily characterised, and consist principally in a form almost always simple, more ovoid, less elongated, and in not growing in any very precisely determinate direction; the hardness and solidity of the flesh is likewise of

much assistance in discriminating the *Sclerotiums* from the greater portion of *Clavarias*.

Sclerotiums, like the *Clavarias*, are found in a great diversity of situations. Some are subterraneous, and grow on the roots of mosses, or in the mass of tan in bark-beds; many are produced in close damp places, screened from the light, as under moss-heaps; some upon the surface of the ground, but under the droppings of cattle. One species comes very near to the nature of a parasitic plant; it grows in Germany on the cabbages which are stored under ground for the winter, and then always springs from the nerves of the vegetable: the greater portion of the species grow upon leaves and branches which are beginning to decay, and seem intended to hasten the dissolution of them. Some are peculiar to the fading foliage of trees; some grow on the rind of living fruits, or on the receptacle of compound flowers; some in the interior of fistular twigs; finally, there are those which grow on the living leaf, after the manner of true parasitic vegetables; that is, by growing from under the epidermis; and if the proposition in regard to *Clavus* is established, we have an instance of one of the genus, which takes its rise from within or near to the germen in Gramina, and is developed in the place of that organ. Among the known parasites, the *Sclerotiums* seem to be among those which affect the general health of the plant the least. All the species (with the exception perhaps of *S. cyparissiæ*), are developed after the plant to which they are attached has done flowering, and rarely affect the form or impede the ripening of the seed.

Mushrooms of a soft substance when young, whose seeds happen to have been developed in a position that does not admit of the complete or natural expansion of the plant, have the curious property of moulding themselves on the surface of the obstacle which presents itself.

The Clavus or Ergot is an elongated excrescence, which fills the place of the seed within the glume or husk of Rye, and several other species of Gramina. Like the generality of *Sclerotiums*, it is a parasitic production; it grows, as they do, upon the living plant, but only when that tends towards

decay; it has, like them, an appointed place of growth. Other species are found on leaves, stalks, receptacles, and fruits; it is therefore not extraordinary that one should be found to grow within the husk of the gramina. A greater diversity of station will be found upon a comparison of that of the various species of *Uredo* and *Puccinia.* If we examine a full grown individual of the Ergot species, we find most exactly the nature, the colour, the form, and even the casualties incident to most *Sclerotiums*; its flesh is firm, white, compact, of one substance; its surface dingy purple; its whole aspect, in one word, so like that of *S. compactum, stercorarium,* and some others, that the analogy could hardly be denied by any one who has had the opportunity of seeing them together. The form of the Ergot is cylindrical, varying in regard to length from 4 to 12 lines, in thickness from 2 to 4 lines, in direction from straight to more frequently curved, and in having or not having a longitudinal groove; variations which correspond with those in the true *Sclerotiums.* In regard to the groove or furrow, it is often wanting; when present, it depends without doubt upon the situation in which the Ergot has been developed, either in relation to the husk or glume, or else to the immediate covering of the germen out of which it is presumed to have originally issued.

But M. De Candolle justly observes, it is not sufficient to prove his proposition, to shew that the Ergot has the form and appearance of a *Sclerotium;* but that it is also incumbent upon him to make it appear, that all we know in relation to its mode of existence, is conformable to that opinion. With this view, he quotes from the work of Mons. Teissier, who had made this production an object of his peculiar attention, the following remarks, made, it is true, in 1783, a period when the history of Mushrooms was known with too little exactness to suggest the analogy now discovered as to its nature. These observations shew:—1. That all causes which tend to increase the degree of humidity, are universally favourable to the existence of Ergot; and we know that the same holds true in regard to all mushrooms, and peculiarly so in regard to the *Sclerotiums.* 2. That there are certain

districts more subject to this disease than others, although under circumstances equally favourable to its appearance; which proves that the Ergot does not owe its rise to these circumstances alone, but that its history falls within the scope of that of organized beings, whose existence is derived from a germ. 3. That the Ergot cannot be produced by watering the ears of corn, and for this reason, the seeds of that mushroom are not then introduced. 4. That the Ergot is strictly topical, one or more seeds in the same ear may be affected, the rest not; and this agrees with what we know of the smuts, and most other parasitical mushrooms. 5. That the Ergot at first soft and pulpy, acquires solidity and length gradually, and that its growth has little correspondence with that of the plant on which it is found: all facts that apply naturally to a mushroom. 6. That the Ergot is not peculiar to Rye; it may be met with on almost all gramina; so a great number of parasitic mushrooms, such as the Puccinia *umbelliferarum*, P. *caricina*, Uredo *rumicum*, U. *ranunculacearum*, U. *violarum*, U. *fabæ*, U. *rinathacearum*, U. *carbo*, U. *capræarum*, U. *rubigo-vera*, U. *hypericorum* U. *receptaculorum*, U. *saxifragarum*, Œcidium *pini*, Œ. *asperifoliarum*, Œ. *cichoracearum*, Œ. *ranunculacearum*, &c. are to be met with indifferently upon almost all the species of the respective natural orders of which they bear the names. 7. That the taste and smell of the Ergot, and above all its acrid and poisonous properties, are well accounted for in regarding it as a mushroom: that the chemical tests to which it has been submitted, have afforded results that agree better with a mushroom than any other vegetable substance. 8. Lastly, that the opinion which imputed the origin of the Ergot to worms or insects, has been long since abandoned, seeing that the worms or insects which have been met with in it are of such rare occurrence, as to shew that they are purely accidental. Among the facts recorded in M. Teissier's work, concerning the Ergot, Mons. De Candolle finds but one which does not directly fall in with his proposition, and that is where M. Teissier remarks, that he has seen seeds one half of which were sound Rye, the other half Ergot or Spur. On this M. De Candolle observes, that the fact is exceedingly

rare; that M. Teissier is the only writer who has seen it, that he himself has been employed for several years past in the study of the Ergot, but has never met with one such instance; yet admitting the fact, with all the confidence to which the observations of M. Teissier are entitled, that it is still within the bounds of analogy, since we frequently meet with seeds of different corn-plants, half of which only consist of smut, a disease admitted to arise from a mushroom; then, as to the particular case of the Ergot, it may be supposed, that in developing itself either a little later, or from a somewhat unusual dislocation, it may, by possibility, have left to the corn-seed, the means of a partial developement, and of grafting itself to its base.

Upon the review of facts, of which the above is a cursory statement, M. De Candolle thinks he is justified in coming to the conclusion, that the Ergot is a species of mushroom of the genus *Sclerotium*, to which he gives the title of *Clavus;* that the *spori* or organs by which the plant is reproduced, are situated at the exterior, and not in the interior; and that the spawn or seed falls to the ground, mingles with the soil, is conducted into the interior of the corn-plant by the water which feeds it, and is forwarded along the vessels, by the circulating juices, to the spot destined for the developement of each germ.

Mons. De Candolle concludes his essay by an ample monograph of the genus SCLEROTIUM, illustrated by a well-executed coloured engraving of nine of the species, together with the substances on which they are found. Among these is the figure of an ear of Rye, with specimens of the Ergot in their natural position.—*See Plate VIII, fig. 3, of the present Number.*

Mons. De Candolle displays considerable ingenuity; but we confess we do not find the industry and resources evinced by the President of our Royal Society, and his coadjutor, Mr. Ferdinand Bauer, in the well-known Treatise on the nature of the Blight in Wheat. In such hands, we suspect that even the slight mist of hypothesis which still dims the point, would have been dispelled.

ART. VII. *On the mechanical Structure of Iron developed by Solution, and on the Combinations of Silex in Cast Iron. By* J. F. Daniell, *Esq. F. R. S. and M. R. I.*

In prosecuting my inquiries into the resistance which mechanical structure offers to chemical action, I have been led to bestow considerable attention upon the difference of the molecular arrangement of various kinds of iron. No subject stands more in need of illustration, nor is there any, perhaps, which is more likely to lead to useful practical results, than one which concerns a substance of such primary importance to the arts.

I have failed to produce regular crystals in iron, by the means which I have successfully employed with the more brittle metals; but that, under certain circumstances, it does assume such forms, is fully demonstrated, by some observations of Dr. Wollaston, upon a mass of native iron, found in Brazil, and which have been published in the last volume of the Philosophical Transactions (1816.) From this Paper I shall make a short extract, for the double purpose of indicating the from of the crystals, and of confirming the general accuracy of my observations upon the resistance of crystalline arrangement to chemical action, by his authority. I am the more happy in being enabled to do this, as I have had but too much reason to suppose that my experiments had failed to produce conviction, where it was so much to be desired.

" The specimen of the iron with which Mr. Mornay very " liberally supplied me for experiment, though it necessarily " bears marks of the hammer by which it has been detached, " presents also other surfaces, not only indicating that its " texture is crystalline, but showing also the forms in which " it is disposed to break, to be those of the regular octohe- " dron and tetrahedron, or rhomboid, consisting of these " forms combined. In my own specimen, *the crystalline* " *surfaces appear to have been the result of a process of*

" *oxidation, which has penetrated the mass to a considerable* " *depth in the direction of its laminæ*; but in the specimen " which is in the possession of the Geological Society, the " brilliant surfaces that have been occasioned by forcible " separation from the original mass, exhibit also the same " configurations as are usual in the fracture of octohedral " crystals, and are found in many simple native metals."

This spontaneous decomposition of the metal in the direction of its crystalline laminæ, is a new and valuable fact in the chain of evidence; and I have myself since observed an analogous instance of similar disintegration. In crossing the Alps, in the course of last summer, I remarked that the veins of carbonate of lime, which run in the mica slate, had their surfaces, which were exposed to the action of the atmosphere, *weathered* into distinct and well defined rhomboids.

But to return to our subject. Although mathematical solids were not discovered by a solution of iron, yet a difference of structure was plainly discernible in the different varieties submitted to the experiment, which is well worthy of attention.

A cube of *gray cast iron*, of a granular fracture, was immersed in diluted muriatic acid. When the acid was saturated, it was taken out and examined. The size of the cube did not appear to be at all diminished, owing to a soft spungy substance, which had not been acted upon. This was easily cut off in large flakes, with a knife. Of this substance I shall have occasion to say more hereafter. The texture of the iron, of course, could not be learnt for this covering. But the metal having been submitted to repeated solution, the quantity of the residuary matter gradually decreased, and the surface being scrubbed with a brush, was found to be covered with small irregular ridges, which, when examined with a magnifier, presented the appearance of bundles of minute needles.

A mass of *bar iron*, which had undergone all the operations of *puddling* and *rolling*, was next submitted to the experiment. When the acid was saturated, it presented the appearance of a bundle of fasces, the fibres of which it was composed,

running in a parallel and unbroken course throughout its length. At its two ends, the points were perfectly detached from one another, and the rods were altogether so distinct, as to appear to the eye, to be but loosely compacted.

The next subject of examination was a specimen of *white cast iron*, of a radiated fracture. The first thing worthy of remark was, that it took just three times as long to saturate a given portion of acid as the two preceding specimens. Its texture, when examined, differed very much. It appeared to be composed of a congeries of plates, aggregated in various positions, sometimes producing stars upon the surface, from the intersection of their edges. It exhibited altogether a very crystalline appearance, but no regular facets were discoverable.

A small bar of *cold short iron* was next selected; it was exceedingly brittle, and its fracture presented bright and polished surfaces much resembling antimony. Its texture, however, when subjected to solution proved to be fibrous, but not so perfectly so as the first specimen of bar iron. The course of the fibres was very much broken, the acid having dissolved out small cavities which cut them short. It was a square bar, and the alternate sides were more acted upon than the others, so that the fibres would moreover appear to have been flattened.

A rod of *hot short iron* presented at the end of the operation, a closely compacted mass of very small fibres, perfectly continuous. The congeries was twisted, but the threads preserved their parallelism. A portion of a gun-barrel was submitted to the experiment. The metal was remarkably free from particles of an extraneous nature. The texture proved to be fibrous, but the threads were not regular or straight. They were generally disposed in waved lines, and the whole together was very compact.

A mass of steel just taken from the crucible in which it had been fused was subjected to the action of muriatic acid. It was of a radiated texture, the upper surface being marked with rays which proceeded from the centre to the circumference. It was readily acted upon by the solvent, and when

withdrawn, presented a highly crystalline arrangement. It appeared to be entirely composed of very bright and minute plates which reflected the light in every direction. The laminæ were very thin, and there was no order discoverable in their mutual positions.

A specimen of cast steel which had been subjected to the action of the tilting hammer of a very fine white granular fracture was next examined. It was not easily acted upon even by strong muriatic acid, and it required the addition of a small quantity of nitric acid to effect its decomposition. When the acid was saturated, the metal still presented a compact appearance; nothing of a fibrous structure was visible; but in one or two places where the acid had acted with most energy, it had detected the edges of laminæ, which appeared to form plates of the extent of the whole surface.

The blade of a razor composed of Wootz steel presented the same appearance, differing in nothing except three large notches in the back at right angles to the edge.

The blade of a razor of an inferior description presented a fibrous texture of waving lines. Deep notches in the back similarly placed were likewise visible in this. It was sufficiently evident, that the fibrous texture of this razor was owing to the admixture of iron and to the imperfection of the process for converting it into steel.

A bar of steel of an even granular fracture was broken into two. The two pieces were heated in a furnace to a cherry red. In this state one of them was plunged into cold water, and the other allowed very gradually to cool by the slow extinction of the fire. They were then both placed in muriatic acid, to which a few drops of nitric acid had been added. The last was readily attacked, but it required five fold as much time to effect the saturation of the acid of the first. When the solvents had ceased to act they were both examined. The tempered steel was exceedingly brittle, its surface was covered with small cavities like worm-eaten wood, but its texture was very compact and not at all striated. The untempered steel was easily bent and not elastic, and it presented a fibrous and wavy texture.

I am inclined to hope that these observations may not be without interest, and that if properly followed up, they may lead to some useful practical results. We find that the excellence of iron for mechanical purposes, depends upon its fibrous texture. The raw material, as we may term the crude cast iron, is better fitted for working in proportion as it approaches to this texture. We can trace a strong analogy between it and other fibrous substances. In flax, and hemp, the fibres are carefully separated from the other constituent parts of the vegetables by putrefaction and beating. In iron, the parts which are not fibrous are thrown off by a species of fermentation, called puddling and hammering. In the former, the fibres are interlaced with one another by tearing them into short pieces, and by a species of carding. In the latter, the same purpose is effected by cutting the bars into short pieces repeatedly, tying them in bundles, and again welding them together. The vegetable fibres are spun out into lengths, and are found to be tenacious and fitted for use. The fibres of the metal are likewise drawn out by rolling, and their acquired toughness, adapts them to the purposes of the arts.

Might not the same twisting of the threads, which is found to give compactness and strength to hemp and flax, be employed with advantage to increase the tenacity of the particles of iron? Is there not something analogous to this in the waved structure of the gun barrel, which is known to be particularly tough? And may not the superior quality of the Damascus sword blades, which is still a problem to our manufacturers, be owing to some such management? Their structure would answer exactly to the idea of small rods of iron and steel welded and twisted together, and afterwards beat out. The experiment is worth the trial.

The good qualities of steel seem to depend for different purposes upon a varying mechanical arrangement of its particles. This difference of structure is conferred by certain regulations of temperature. We find that the same bar of metal suddenly cooled from a high temperature is possessed of a quite different texture, and different mechanical properties from those which characterise it, when gradually lowered.

May not the qualities of cast iron vary also with the rate of cooling? and might not a proper regulation of heat improve the fibrous texture, or even confer a certain degree of malleability?

I proceed now to a very different species of investigation, into which I was naturally led, while prosecuting the preceding experiments. I have mentioned above, that in dissolving the cube of gray cast iron, a porous, spungy substance was left untouched by the acid. This was easily cut off with a knife. It was of a dark gray colour, somewhat resembling plumbago. Some of it was put to dry on blotting paper, and in the course of a minute, spontaneously heated and smoked. In one instance, when a considerable quantity had been heaped together, it ignited, and scorched the paper. Its properties were not impaired by being left for days and weeks in the solution of iron, or in water. I left some for three months covered with a solution of sulphate of iron, and exposed in an open dish to all the changes of the weather. At the expiration of that time, red oxide of iron had been deposited from the sulphate, but the black matter when collected upon blotting paper, raised the thermometer twenty degrees. Muriatic and sulphuric acid both extracted the substance. When nitric acid was used, the plumbaginous matter was produced, but no longer heated in the air. I immediately commenced a series of experiments for the purpose of ascertaining the nature of a body which presented such a curious anomaly.

A portion of it just prepared was placed in a shallow dish upon the water trough, and a bell glass of common air inverted over it. The water gradually rose, and the residue of the air being examined at the end of twenty-four hours, it was found that the oxygen had been totally absorbed.

Another portion was put into a retort to which a stop-cock had been adapted. The air was exhausted, and the moisture allowed to evaporate. Oxygen gas was then admitted. It became very hot, and the gas was absorbed. There was no change of appearance in either experiment. In chlorine it also became very hot, and a yellow liquid formed. This was

washed out. A black powder was left of a high metallic lustre resembling plumbago. The solution was precipitated with ammonia, and afforded nothing but black oxide of iron.

After the residue of the iron had absorbed its dose of oxygen, it was heated to redness, and digested in muriatic acid to take up all the oxide of iron with which it was necessarily mixed. When well washed and dried, it exactly resembled that which had been prepared with chlorine; 320 grains afforded 95.6 of the metallic powder.

The muriatic solution was precipitated by ammonia. The precipitate was boiled with a little nitric acid and heated to redness. It weighed 166.8.

Muriate of barytes was poured into the solution of muriate of ammonia, from which the oxide of iron had been collected, and a dense white precipitate of sulphate of barytes was formed, weighing, when washed and dried, 178.4.

From these preparatory experiments then, we learn, that the residue of the cast iron, after the action of sulphuric acid, heats, in consequence of its uniting with the oxygen of the air; and this residue, after it has so absorbed oxygen, is composed of

Oxide of iron - -	166.8
Sulphuric acid, - -	60.4
Gray substance, with metallic lustre,	95.6
	322.8

The increase of weight being probably owing to the higher oxigenation of some of the iron, by boiling in nitric acid.

The next object of inquiry, is the nature of the gray substance unacted upon by the acids.

Nitric acid, and nitro-muriatic acids, did not act upon it at a boiling heat.

When examined with a magnifier, it did not seem to be perfectly homogeneous in its composition, but presented the appearance of bright metallic particles, powdered and mixed with a grayish white dust. It deflagrated with nitre and oximuriate of potash at a very high heat.

Some of it was fused with pure soda in a silver crucible.

When it entered into igneous fusion, a gas was given off, which burnt with flame, and slight explosion. When cold, it was of a greenish colour. It was dissolved out with distilled water, and much of the powder was found to have been unacted upon. It was digested in muriatic acid, and had now assumed a brighter aspect, and was of a perfectly uniform texture, exactly resembling micaceous iron ore in small thin scales. The muriatic acid had taken up some oxide of iron.

The sodaic solution was saturated with muriatic acid. It effervesced strongly. It was evaporated, and when reduced to about one half, it gelatinized. When perfectly dry, the muriate of soda was dissolved, and nothing but pure silex remained.

Guided by these hints, and by many other preparatory experiments, which it would be tedious to enumerate, I obtained the following more determinate results.

35 grs. of the gray powder, which had been thoroughly separated from all oxide of iron, by digestion in muriatic acid, were exposed to a low red heat, in a silver crucible, with 200 grs. of pure soda. When a puff of gas took place, the crucible was instantly removed from the fire. The contents were dissolved out with distilled water. The solution was filtered, and the residue well washed and dried. It weighed 10.9 grs. It was digested in muriatic acid, again washed and dried. It then weighed 10.0. It now exactly resembled the micaceous iron.

The muriatic solution let fall a small quantity of red oxide of iron upon the addition of ammonia.

The sodaic solution was saturated with muriatic acid. It barely effervesced. It was evaporated to dryness, and towards the end of the operation, it gelatinized. It was diligently stirred till dry. The muriate of soda was dissolved, and the remaining white insoluble substance heated to redness. It then weighed 23.8 grs. and possessed all the properties of silex.

Here then we arrive at another step of our inquiry; and we find that the 95.6 grs. of the gray substance, is composed of

65.0 silex,

30.6 metallic substance, like micaceous iron.

for 35.0 : 23.8 : : 95.6 : 65.

The small quantity of oxide of iron obtained, and the slight effervescence of the soda, was owing, as we shall afterwards find, to the decomposition having been carried a little too far.

50 grs. of the micaceous substance, which had all been subjected to the action of red hot soda, were mixed with 500 grs. of pure soda, in a silver crucible. It was exposed for two hours to a heat just short of the melting of the silver. A large quantity of inflammable gas burned off. When this had ceased, the crucible was removed from the fire, and allowed to cool. It was digested in distilled water, and the solution passed through the filter. What remained was well washed and dried, and weighed 31.8.

This was digested in muriatic acid, and afterwards weighed 23.8.

The muriatic solution was precipitated with ammonia, and the red oxide of iron weighed exactly 8.0 grs. corresponding to the deficiency of weight. The remainder was found to be the micaceous substance, totally unaltered in its characters.

The sodaic solution was neutralized with muriatic acid, and gave off carbonic acid in abundance.

It was then evaporated to dryness, and, during the process, it gelatinized. It was digested in distilled water, and the remainder, which was perfectly white, heated to redness. It weighed 5.8.

Again, to collect the results as we proceed—50 grs. were employed, of which 23.8 were unacted upon. The 26.2 furnish us with,

8.0	oxide of iron.
5.8	silex.
12.4	loss.
26.2	

To ascertain the nature of this loss, which, from previous experiments, is probably carbon, the following experiments were undertaken.

10 grs. were accurately mixed and triturated in a mortar, with 400 grs. of oxymuriate of potash. This mixture was

put into an apparatus composed of part of a gun barrel, closed at one end, and furnished with a flexible metallic tube at the other, which dipped into the first of a series of Woulfe's bottles charged with lime water. A strong red heat was applied to the barrel, and the carbonic acid produced precipitated the lime in the bottles, the last of which remained perfectly clear and undisturbed. The precipitate was carefully collected and dried; it weighed 38 8 grs.

Now, 100 parts of carbonate of lime contain 44 carbonic acid, therefore 100.0 : 44.0 : : 38.8 : 17, and 100 carbonic acid contain 28.6 of carbon, and 100.0 : 28.6 : : 17.0 : 4.8.

But in the barrel, 0.8 grs. were found to have been unacted upon. Therefore, 9.2 of the carburet contains 4.8 of carbon.

If we now apply this to the preceding experiment, we shall find that there is an excess in the products,

For 9.2 : 4.8 : : 26.2 : 13.6,

which gives the result—

8.0	oxide of iron.
5.8	silex.
13.6	carbon.
27.4	
26.2	
1.2	excess.

Of this excess in the products, we shall consider the cause hereafter.

I shall proceed at present to relate another experiment which remarkably confirms the results of the others, though by a totally different method.

28.5 grs. of the carburet were mixed with 500 grs. of pure soda, and placed in an iron tube, similarly prepared to that in the last experiment. It was gradually heated to redness, and when gas began to be given off, the flexible pipe was adapted to it, and passed under the surface of lime water, in a Woulfe's bottle, communicating with the pneumatic trough. The heat was raised to a bright red, and continued for two hours. The gaseous products were collected in a bell glass,

having passed through the lime water without producing any milkiness. The gas collected amounted to 56 cubic inches.

When the gas had ceased to come over, the apparatus was allowed to cool, and the contents of the barrel washed out. The solution was passed through the filter, and the substance remaining upon it, washed and dried, weighed 13.5. It was digested in muriatic acid, again washed and dried, and weighed 6.5. It was the carburet unaltered. The loss of weight was owing to oxide of iron, as shewn by the examination of the muriatic solution.

The sodaic solution was put into a gas bottle, fitted with an acid holder, and communicating with a mercurial gasometer. Muriatic acid was allowed to mix gradually with it, and 39 cubic inches of carbonic acid were thus collected. The solution was then evaporated to dryness. The silex being washed and heated to redness, weighed 4.9.

The gas which had been collected was next examined.

It burned with a yellow flame. When sulphur was sublimed in it, carbon was deposited, and when exploded with chlorine, fuliginous matter lined the tube.

A cubic inch of the gas was mixed with two cubic inches of oxygen, in an exhausted tube, and fired, with an electrical spark, lime water was admitted and agitated. Carbonate of lime was formed, and the absorption was $\frac{25}{10}$. The residue consisted of oxygen, and varied in different experiments, from $\frac{5}{10}$ to $\frac{6}{10}$ of a cubic inch. When the oxygen was decreased in this proportion, the absorption was within $\frac{1}{10}$ of being total; and this small residue was probably owing to a little atmospheric air.

Now, as pure carburetted hydrogen condenses just double its bulk of oxygen, it follows that a little hydrogen was mixed with this gas, and an average of the experiments would make the mixture 50 cubic inches of carburetted hydrogen, and 6 inches of hydrogen.

Of 28.5 grs. of the carburet employed, 6.5 were recovered unaltered. 22 grs. were therefore decomposed. 39 cubic inches of carbonic acid weigh 18.3, and contain 5.0 of carbon,

and 50 cubic inches of carburetted hydrogen weigh 8.5, and contain 6.2 of carbon.*

The analysis therefore stands thus :—

7.0	oxide of iron.
4.9	silex.
11.2	carbon.
23.1	
22.	
1.1	excess.

Considering the complication of these experiments, and the difference in the method of operating, their agreement is nearer than could well have been expected.

The excess in the products is no doubt owing to the oxigenation of one or more of them in the process. The iron, as it is obtained in the results, is in the state of red oxide. If we suppose that it exists in the double carburet in the metalline state, there would be a deficiency instead of an excess. For 7.0 red oxide of iron, is only equal to 4.8 of the metal, and thus the result would be—

4.8	iron.
4.9	silex.
11.2	carbon,
20.9	
1.1	deficiency.
22.0	

I am inclined, from all circumstances, to believe, that the triple carburet, as it is first obtained, consists of iron and

* These calculations are made from Davy's Elements. The barometer, at the time ofthe experiment, was 29.74, and the thermometer 55°. I have not made the calculation for the mean pressure and temperature, the difference being so small.

silicum, in the metalline state, united to carbon. When brought into contact with oxygen gas, the metals become converted to protoxides, giving out heat, without separating from the carbon; and when decomposed at a red heat by soda, they become oxigenated to the utmost, at the expense of the water which is still found in the alkali at that temperature.

Red oxd. iron 7.0 =	6.2	black oxd.
	4.9	silex.
	11.2	carbon.
	22.3	
	22.	
	.3	surplus,

arising from the oxigenation of the silex?

This idea is further confirmed by the following experiment. 3 grs. of the double carburet, perfectly pure, were placed in a glass tube, with one gr. of potassium. The air was exhausted, and the tube heated to redness. It was then allowed to become perfectly cool. When the air was admitted, the ingredients became instantly red hot. Upon washing the products, the carburet was obtained unaltered.

The following comparative experiments mark a distinctive difference between this body and some others, and confirm the general results.

Plumbago and potassium, heated in the same way in vacuo, did not heat upon the admission of the air.

Lamp black and potassium did not heat. Plumbago, in an ignited stream of mixed oxygen and hydrogen, burnt away, and left a red ash.

The double carburet, burnt in the same way, left a white ash.

Carbon collected from the solution of steel in an acid, possessed no metallic lustre, and ignited at the flame of a common candle, burning like tinder. The carburet was not affected by any heat short of that of the blow pipe.

I wish, in conclusion, to draw attention to certain analogies

which subsist between these experiments, and others performed by more able hands, for the purpose of establishing the existence and properties of silicum.

Sir H. Davy, in his Elements of Chemical Philosophy, says, "When potassium is brought in contact with silica, ignited "to whiteness, a compound is formed, consisting of silica "and potassa, and black particles, not unlike plumbago, are "found diffused through the compound.

"From some experiments I made, I am inclined to believe "that these particles are conductors of electricity; they have "little action upon water, unless it contain an acid, when "they slowly dissolve with effervescence; they burn when "strongly heated, and become converted into a white sub"stance, having the characters of silica."

When it is considered that most of the potassium, which is prepared for experiment, however well it may be cleaned, contains no inconsiderable portion of carbon, is it improbable that these particles, not unlike plumbago, may have been a carburet of silicum? Its little attraction for the oxygen of water, agrees very well with the phenomena which we have just been considering.

Professor Berzelius, and M. Fred. Stromeyer, have succeeded in producing a compound, which they consider as a combination of iron, silicum, and carbon. Their method was to select very pure iron, silex, and charcoal. These they made into a paste, with gum or linseed oil, and heated them very intensely, in a covered crucible. Their reasons for supposing that silicum, in the metallic state, existed in the product, were these, That the iron and silex extracted from the alloy, when taken together, very sensibly exceeded the weight of the alloy examined: that the alloy gave a much greater quantity of hydrogen, with muriatic acid, than the iron alone which it contained would have given; and that there is no known combination of a metal with an earth, which requires the successive operation of the most powerful agents to decompose it as this alloy did. The colour of this compound was that of common steel.

The quantities of the component parts, however, of this

alloy, differed very materially from those of the purified carburet obtained from cast iron. They varied from 85.3 of iron, 9.2 of silicum, and 5.3 of carbon, to 96.1 of iron, 2.2 of silicum, and 1.6 of carbon. They were likewise highly magnetic, (owing no doubt to the great quantity of iron), which the triple carburet is not.*

I have stated, that the quantity of the silex and triple carburet yielded by the iron which I employed, rather decreased in the interior of the mass. Towards the latter end of my experiments, I estimated the relative proportions. The iron was dissolved in muriatic acid, and the insoluble residue, after it had absorbed its dose of oxygen, was digested in muriatic acid. These solutions were precipitated by ammonia, evaporated to dryness, and exposed to a strong heat. The residue was boiled to dryness, with a little nitric acid, and again heated. The quantity of red oxide of iron thus obtained, amounted to 738 grs. which are equal to about 513 grs. of metallic iron.

The quantity of the gray mixture of silex and double carburet, amounted to 93 grs.

The mean results of all the experiments stand thus—

	1000 grs. of the gray cast iron,		
yield	846.6 iron.		
	153.4 consisting of	silex	104.3
	1000.0	double carburet	49.1
			153.4

100 grs. of the double carburet of iron and silex, upon an average of five experiments, gave the following results—

Red oxide of iron	31.2	=	28.0 black oxide.
Silex .	22.3	=	20.6 oxide of silicum ?
Carbon .	51.4	=	51.4 carbon.
	104.9	=	100.0

* See Phil. Mag. No. 173, translated from the Swedish original; and Ann. Chim. tom. 81, from Gottingen Trans.

Although the existence of silicum in the metallic state, alloyed with iron, is not actually proved by the foregoing experiments, yet the probability of such a compound, I conceive, is greatly increased by them. Indeed, reasoning from analogy alone, it is hardly possible that ten per cent. of silex, could exist in union with the metals in any other manner. When we look to the result of intensely heating the oxides of the alkaline metals, in contact with iron, it would be surprising if the earthy oxides could resist decomposition, in the long continued and intense heat of the iron furnaces.

The process of puddling is almost evidently dependent upon the same supposition. The oxidation of the metals of the earths, is more likely to produce the heaving and internal motion of the iron in that process, than the mere burning away of carbon; and the sudden visible spontaneous increase of temperature, can hardly be explained upon any other principle. I have examined the slag or black oxide, which is pressed out from the iron by rolling, after it has undergone this operation. I extracted the greater part of the black oxide of iron which is combined with it, by muriatic acid; the matter which was left was a complete glass, composed of above 80 per cent. of silex with lime. There was no trace of carbon. Such a result is exactly consonant with this idea of the process.

Much remains still to be done, to complete our knowledge of the nature of cast iron. Notwithstanding the numerous experiments which have been made upon it, we remain in comparative ignorance of its composition. Guided by the new lights which the science of chemistry has lately acquired, an accurate revision of the subject could not fail to repay those who have an opportunity of tracing the changes of the metal in the various stages of its manufacture.

ART. VIII. *Historical Notice of* M. Péron (M. Deleuze, *Ann. du Mus. d'Hist. Nat.* T. 17, *Eloge Historique de* F. Péron, *Par.* M. Alard).

THE sentiment occasioned by the death of a veteran of science partakes more of admiration than regret, and the panegyric we are eager to pronounce upon him, has ourselves and mankind in view, rather than him upon whom it is pronounced. But to eulogize the man who reaped no reward for his labours in his life, and had not time even to complete them; to bestow on him full and discriminating praise; to point out the importance of what was done, and what was to be expected; to pay a tribute of regret and affection to the memory of one whose claims upon our admiration were cut short by misfortune, is a duty imposed on us by humanity and generosity; and the performance of it is sure to be approved, as it appears to arise from a sense of gratitude, and to be purely disinterested. These sentiments are suggested by the premature death of the naturalist who is the subject of the present Memoir. His works, though sufficient to ensure him a distinguished rank amongst men of science, are far inferior to those for which he had made preparation; and the mass of information he collected will no doubt materially facilitate the means of understanding a part of natural history, which had been till his time much neglected. In tracing the outline of the life of Péron, it will be seen how much may be attained by one who, with a strong and active mind, without assistance or guide, entirely dovoted himself to the pursuit of science.

Francis Péron, Correspondent of the Imperial Institute, Member of the Medical, Philomathic, and many other learned Societies, was born at *Cerilly*, in the department of the *Allier*, on the 22nd of August, 1775. He early shewed signs of genius, and almost from his infancy exhibited an ardent desire for the acquirement of knowledge. Being left on his father's death without provision, his family were desirous that he should learn some trade by which he would be enabled to maintain himself; his intreaties, however, prevailed with his mother,

and he was entered at the college at Cerilly. The Principal, pleased with the talents and the disposition of his scholar, bestowed particular attention on him; and when he had gone through a course of rhetoric, recommended him to study divinity; and the minister of the parish consented to take him into his house, and instruct him in philosophy and theology.

Up to this period Péron, who had been solely engaged by his studies, was utterly a stranger to the events which were passing in the world. The Revolution had commenced: dazzled with the principles of liberty which led to it, he at once determined on a military career, quitted his tutor, for whom, however, to the last, he entertained a sentiment of gratitude, and enrolled himself in one of the national regiments. At the end of the year 1792 he was sent to the army of the Rhine, and from thence to Landau, which was then besieged. After the siege was raised, he rejoined the army opposed to the Prussians at Wessemburg, and which received a check at Kaiserlautern. In this affair Péron was wounded and made prisoner, and sent first to Wesel, and from thence to Magdeburg.

Even his captivity was of service to him. He had during the campaign devoted all his leisure time to study; all the money he could procure he now employed in the purchase of books. Several persons, interested by his manners and appearance, lent him many: the whole period of his captivity was devoted to general study. At the end of 1794 he was exchanged, and went to Thionville, where he procured his discharge as disabled, having lost an eye.. In August 1795 he returned to his native town, being then about twenty years of age. After devoting some months to the society of his mother and sisters, he became desirous of procuring some situation in which, by the exercise of his talents, he might be able to support himself. Having been successful in an application to the minister for an appointment of student in the medical school, he went to Paris, where, during three years, he applied himself very diligently not only to the study of medicine, but to those of zoology and comparative anatomy. He took his doctor's degree, and would perhaps have been amongst the most distinguished of the faculty, but

for an unfortunate event, which induced him to renounce his intentions of practising physic.

Péron, who had a lively imagination, and an ardent disposition, early formed a romantic attachment for a young woman in Paris. The hopes of future success in his profession, by which he should be enabled to support her whom he loved, served as an additional stimulus to excite him in his studies; but obstacles, which his eagerness and inexperience had induced him to disregard, destroyed all his hopes, and he was rejected by his mistress on account of his poverty. Overcome by despair, he eagerly sought to quit for ever scenes which reminded him of his disappointments. One violent passion is only to be opposed by another of equal force of a different nature. The army would have suited the disposition of Péron; and possessed of talents and intrepidity, he might have hoped to reach the highest rank; but the loss of an eye was an obstacle to his again entering into the service. The profession of medicine, and the pursuit of science, might still have had sufficient attraction for him; but how pursue his studies, surrounded by objects that perpetually reminded him of his misfortune? A rapid succession of events, by which he might be unceasingly occupied, was necessary to divert his mind from the recollection of the past, and he determined to travel. The French Government having ordered an expedition to be fitted out for the South Seas, two ships, *Le Géographe* and *Le Naturaliste,* commanded by Captain Baudin, were then lying at Havre, ready to sail, only waiting the last instructions from the minister. Péron applied to be employed: but the number of scientific persons intended to accompany the expedition being completed, he was at first unsuccessful in his request: he then addressed himself to M. de Jussieu, one of the persons charged with the selection of the naturalists, and begged him to interfere: "Let me but embark, and you shall see what I will perform," said he; and as a justification of his presumption, he proceeded to explain his plans and his views, with an earnestness and zeal which gave reason to conjecture he was capable of executing even more than he proposed.

M. de Jussieu, struck by his singular eagerness, advised him to draw up a memorial, stating his objects; and on reporting to his colleagues his interview with Péron, they determined in concert with the Count Lacépede, not to reject the services of a young person who possessed such extraordinary ardour, combined with so much knowledge. A few days afterwards he read to the Institute a paper on the utility of adding to the other scientific persons destined to accompany the expedition, a medical naturalist, specially charged to make enquiries into the history of man, and was unanimously elected one of the zoologists of the expedition. Péron was now about to seek in another hemisphere that fame which might recompense him for the loss of the domestic happiness to which he had in vain aspired. He spent the remaining few days in obtaining instructions from MM. de Lacépede and Cuvier, which might direct his studies. He attached himself principally to zoology, as the part of natural history which afforded the most extensive and most novel field. The two frigates sailed on the 19th of October, 1800: he was on board the Géographe. He united himself with all those whom, like himself, the love of science had determined to brave all dangers. He, however, contracted a particular intimacy with M. *Lesueur.* He lost not an instant: and even on the very first day of his going on board, commenced some meteorological observations, which he continued to repeat at intervals of six hours during the whole voyage; and during the early part of the voyage he made several very ingenious experiments on the temperature of the sea.

On approaching the equator they observed the ocean entirely covered with a phosphorescent light, which they found to proceed from innumerable animals whose colour resembled burning coals. Many of them were examined by Péron; and he observed, that while under examination they successively assumed the different prismatic colours until the irritability with which they were induced was exhausted.

The impresssion made on Péron by this phenomenon, and the singularities which he observed in the organization of this zoophyte, determined him to study more particularly the

animals of that class: and during the remainder of the voyage he and his friend Lesueur were occupied in observing the different specimens they were able to procure from the sea.

Lesueur painted, under the direction of Péron, these different animals as they were taken from the water and before their fleeting colours escaped, the two friends having agreed to unite their labours; the one designing, and the other describing the different objects they discovered. After a voyage of five months, they arrived at the Isle of France, where they were to take in the stores necessary for their course to Terra Australis. Many of the naturalists finding that the proper supplies were not furnished, and disgusted with the imperious and oppressive conduct of the Commander, determined to proceed no further. Péron, notwithstanding these obstacles, held himself bound by his engagements, and did not abandon the expedition. We shall not enter into any detail respecting the voyage, though we may remark on one or two of the most important objects.

On leaving the Isle of France they made for the westernmost point of New Holland, and anchored in a bay which they named *Bai du Géographe*, and after coasting along the west coast, went to Timor; and it was principally during Péron's residence at that place, so little known to naturalists, that he collected his information on the moluscæ and zoophytes: the sea being very shallow, the excessive heat of the sun caused these curious animals to multiply in great numbers on those coasts.

Péron's whole days were spent on the strand, wading amongst the reefs, endangering his health, and even his life. He did not return home till night-fall, loaded with the various animals he had procured, which he spent the night in examining, and the more remarkable of which were drawn by his friend. Notwithstanding the illness which had attacked some of the party, and the dangers to which he was exposed, his zeal was unabated; the eagerness with which he collected different objects of natural history, did not, however, prevent his making observations of a different nature: he

spent several days in the interior, for the purpose of studying the character and manners of the natives.

Struck by the fact, that the members of the expedition had been nearly all attacked by illness, whilst the inhabitants escaped the influence of the climate, he conceived, after careful observation, the difference to arise from th constant use of betel by the natives.

On quitting Timor, they proceeded to the south cape of *Van Dieman's* Land, and after reconnoitering the eastern side, they entered Bass's Straits, and coasted along the southern part of New Holland. We shall not trace the melancholy picture of their sufferings: it will be sufficient to remark, that on their arrival at Port Jackson, there were not more than four of the crew capable of duty; and that had they been kept at sea a few days more, they must have perished.

After the departure from Port Jackson, whence the *Naturaliste* was sent back to France, a navigation not less perilous than that which they had accomplished remained to be performed. The islands situated at the western entry of Bass's Straits were to be examined, and they were again to sail round the coasts of New Holland, and enter the Gulph of Carpentaria. Péron was indefatigable in his researches for every object of natural history, and in his observations on the natives.

Of five zoologists who had been appointed to the expedition, two had remained at the Isle of France, two had died before the beginning of the second year, and thus Péron alone remained: regardless of all privations, his mind was solely occupied with the objects of his appointment; and the commander having refused to allow the spirits necessary to preserve the objects of natural history, Péron hoarded up during the remainder of the voyage his personal allowance, and applied it to preserving his specimens. Péron having gone on shore with some of the naturalists at King's Island, the vessel was driven off the coast for fifteen days. He is said never once to have lost his calmness for a moment, quietly continuing his researches, as if regardless of what was to happen. During the time he was in that inhospitable island, he collected one

hundred and eighty species of moluscæ and zoophytes; he collected materials respecting the phocæ, which frequented the shores in large numbers; and he has given an interesting account of the mode of life of twelve wretched fishermen, Englishmen, who, cut off from the rest of mankind, spent their time in collecting oil, to be carried away, at distant intervals, by the English ships. These miserable beings chiefly subsisted on kangaroos, and one or two other animals, which they caught with dogs. They willingly shared their wretched fare with the travellers—receiving them with that simple hospitality which is perhaps oftener found amidst the rude and thinly scattered inhabitants of an ungrateful soil, than in civilized and polished society, where selfishness, and the clashing of interests, serve to deaden the natural feeling of pity. On their last stay at Timor, Péron completed his observations on that island.

He had frequent intercourse with the natives, whose manners and government he was now better able to observe, as he had acquired the Malay language.

The winds preventing their making the coast of New Guinea, and entering the Gulph of Carpentaria, they returned to the Isle of France, where they remained five months. Whilst there, Péron, after he had arranged his collection, devoted his time to the study of the moluscæ and fish on the coast; aud, notwithstanding the researches of the different naturalists who had preceded him, succeeded in discovering many new species. They staid at the Cape a month, during which time he made some observations on the Boshmen. At length, after an absence of three years and six months, he disembarked at L'Orient, the 7th April 1804, and repaired immediately to Paris.

He employed some months in arranging his collection of specimens, and making a catalogue, previously to their being deposited in the Museum. After this was accomplished, he went to Cerilly, to see his mother and sisters. His health, weakened by the fatigues he had undergone, and by the beginning of a disorder which soon after shewed itself more plainly, rendered rest and quiet absolutely necessary.

Secure, in the consciousness of having well performed his duty, he did not think it necessary to take any particular steps with Government, in explanation of what had been done during the voyage. He had not, however, been long in the enjoyment of domestic quiet, when, to his surprise, he learnt that some persons had attempted to persuade the administration, that the object of the expedition had failed. On this, he instantly returned to Paris, to refute these calumnies.

He waited on the minister for the naval department, and with modesty, but firmly, stated what his companions had done for the sciences, of geography, mineralogy, and botany; and gave in a list of the different objects which they had brought back—the drawings of Lesueur, and the observations and descriptions which he had collected. All the questions which were put to him, were answered with great perspicuity and naïveté; and such was the impression produced that the minister, convinced of the importance of what had been achieved, undertook to have the nautical part of the voyage compiled by M. Freycenet, (one of the principal persons employed during the voyage;) and to apply to M. De Champagny, the minister of the home department, in order that similar directions might be given with respect to the historical part.

The same success attended him with M. Champagny. He was received with the most flattering attention; and the publication of the narrative part of the voyage, and of the description of the new objects of natural history, was entrusted to him, in conjuction with his friend Lesueur. Thus, Péron was at once brought into notice; and he who till then had been nearly unknown, was, on a sudden, courted and eagerly sought after.

The collection deposited in the Museum, was examined, and a commission named by the Institute to make a report on it to the Government. The result of which was, that it contained more than 100,000 specimens of animals, amongst which were several new genera, and above 2500 new species; thus M. Péron and Lesueur had alone discovered more animals than all the modern travellers put together.

Although he was chiefly occupied in the preparation of the account of his voyage, he composed several memoirs, which were transmitted to the Institute, and several other learned Societies. Amongst the rest, were essays on the genus pyrosoma, the phosphorescent zoophite before mentioned, on the temperature of the sea, on the petrified zoophites found in the mountains of Timor, on the dysentery of warm climates, on the use of betel, on the health of mariners, and on the relative strengths of savages and civilized persons; and he also undertook a complete history of the medusæ, which he had particularly studied, and of which he had collected a considerable number of species, till then unknown. The first volume of this account of the voyage was published about nine years ago; and from this an estimate of the merit of Péron may be formed. We shall content ourselves with a few general remarks, on a work so recent, and so well known. The facts are stated with great clearness and precision—one of the most important qualifications of a work of this nature; there is much curious matter in the description of the soils and climates of the different countries. The account of the different races of people which inhabit the Straits of New Holland and Van Dieman's Land, has brought us intimately acquainted with two of the most ferocious tribes of savages, and exhibits the human species in the most degraded state in which it has as yet been discovered.

No former voyager, with the exception perhaps of Forster, has so well seized on the physical and moral characters of the different tribes of the South Sea islanders; and, if Forster's narrative is more entertaining, Péron has no where like him indulged in theoretical speculations; and his work is free from that air of fiction, which is the great defect of the work of Forster.

Péron was more attached to zoology than to botany; and it is to be regretted, that he did not attend more to the vegetable productions of the different countries he visited. His style is not sufficiently simple for a narrative. Yet though generally too florid, there are many passages of exquisite

beauty. We refer particularly to his description of Timor, and the inhabitants of Van Dieman's Land—passages not unworthy of the pen of Buffon.

There is no part of his work which is so deserving of attention, as that in which he considers the advantages of civilization; and he has with singular felicity, thrown new lights, and added fresh interest, by a combination of new facts and suggestions, on a subject which seemed to have been long exhausted.

Part of the second volume of his voyage was printed in his life, but he did not live to complete it. This is very lately published; and we shall, in a subsequent article of this Journal, notice its contents.

In addition to the different memoirs published by Péron, on zoology, he was occupied in collecting materials for a more considerable work, on the the different races of mankind; and had, with great industry, compiled information from all the preceding voyagers and physiologists on this subject; and besides this he had himself opportunities of examining the inhabitants of the Cape, the aborigines of Timor, the savages of New Holland and Van Dieman's Land, and had prepared a philosophic history of different races of mankind, with reference to their physical and moral qualities. This, however, he did not mean to publish till he had accomplished three voyages. One to the north of Europe, and part of Asia. Another to India; and the third to America: and he intended to devote fifteen years to the completion of this task. His whole plan was completely digested. He had collected all his questions, and was unceasingly occupied in solving the different problems which he had proposed.

Many of his memoirs on this interesting subject were from time to time condemned, as he discovered his errors or misconceptions; but the fragment containing the history of the people of Timor is nearly completed; the figures to accompany it were drawn on the spot, and the expense of engraving them, is the sole obstacle to its publication.

His portfolio contained a vast collection of descriptions of the birds, quadrupeds, and fish, which he had seen; and more especially of the animals without vertebræ, the history of

which he had undertaken, and of which his friend had made more than a thousand drawings.

These will probably be published by M. Lesueur, in conjunction with the professors of the Museum.

His character is thus drawn by M. Deleuze: Péron was eager, not only to improve his understanding by the acquisition of knowledge, but also to correct his faults, and to perfect his moral qualities. He had studied himself in this respect, and had committed to writing his observations on his own character. In these observations, which were not meant to meet any other eye than his own, he has been as unreserved in his praises as in the blame of himself; and we cannot better characterise him, than by the following extract from one of his notes, found amongst his papers Its date is November 1800—written therefore at a time when he could not have supposed that he should attain a celebrity which would render its publication probable.

" Heedless, giddy, disputatious, self-willed and opiniated, unbending to the will of others, I foresee, I shall at once make a thousand enemies, and alienate the esteem of my best friends. These defects are somewhat attributable to my education, and solitary and independent habits of life. Though I am aware that they obscure the better parts of my character, yet such is the irresistible force of habit, that all attempts at correction have as yet been fruitless. Nevertheless, I feel I have no cause to blush at my faults, for be they what they may, I am guiltless of intentional wrong; and the sincere regret which has always followed the commission of error, has hitherto satisfied my own conscience. These defects of my head are, I think, compensated by some good qualities of my heart.—I believe myself to be feeling, kind, and generous.—I am not conscious of ever having willingly wronged a single creature; and though my friends may have suffered for my intemperate sallies, and may have had reason to complain of my indiscretions, still they have always been willing to admit the goodness of my heart, and acknowledge my attachment and kindness to them. These qualities have accompanied me through life; and at college, and with the army, it enabled me to conciliate the esteem of those with

whom I was brought in contact; and often induced me to succour those unfortunate victims, who, by the ambition of their sovereigns, became a prey to the fury of the French army. Alas! how frequent has the glory of our soldiers been tarnished by rapine and cruelty! How often has my heart bled at cruelties I could not prevent, but in which I never concurred. Young and enthusiastic, none can say that misfortune has not always found in me a zealous friend. A stranger to the tone and manners of society, with an impetuous and uncontrollable imagination, and a frankness always imprudent, and frequently bordering on ill-breeding; obstinate in the support of my own opinions, and heedless, I have often for a time alienated the esteem of my friends; but as soon as passion passes away, and reason regains its empire, I have blushed at my violence, and eagerly sought the pardon of those whom I had offended. The sincerity of my excuses and professions has always been successful, and I still possess the esteem of my friends, though there is not one but has had some cause of complaint."

The candour of this confession, cannot but interest the reader in the favour of Péron. All those who were in habits of intimacy with him, recognized the fidelity of the portrait, except that he was in error, where he attributes the attachment of his friends solely to the goodness of his disposition. This quality, instead of being accompanied, as in many, by inefficiency and weakness, was in him united to courage, and an activity and zeal, which rendered him often of the greatest service to others.

He not only acquired the esteem and the friendship of those with whom he lived, but contrived to gain an ascendancy over their minds, which was the more extraordinary, considering his ignorance of the world, and as he could have bestowed but little consideration on the means of governing others, or of gaining partizans.

Simple and unpretending in all common occurrences of life, in those of importance, Péron was another being; his mind became exalted, his discourse and gesture imposing, and he commanded his equals as though he conceived they had not power to resist his will. None, however, were more gay,

lively, or good tempered; nor more willing to overlook the defects of his acquaintance, when he found them united with good qualities.

Some periodical work having stated his merits to be superior to those of a very distinguished foreign traveller, he lost not a moment in desiring its contradiction: "I don't fear," said he, "to be thought vain enough to be privy to such an exag-"geration of my merits; but it is an injustice done to ano-"ther, even to let such a statement pass uncontradicted."

Many instances of his disinterestedness and liberality are related by his biographers. The pension which had been granted to him being scarcely sufficient to supply him with necessaries, the minister offered to appoint him to an office at once lucrative and honourable, but he refused, observing, "That he had devoted himself entirely to the cause of science; "and that if he took a place, it would become him to attend "to the discharge of its duties; and with his objects and "engagements, he could not consider his time at his own "disposal."

As soon as he was nominated to the charge of drawing up the history of the voyage he had been engaged in, he resided constantly in Paris, lodging, with his friend Lesueur, in a small apartment near the Museum.

He practised the most rigid economy, in order that he might be enabled to spare part of his scanty allowance to his sisters, who were living in poverty and obscurity. The disorder on his lungs began to make a fearful progress, and it was considerably increased by the shock he received from the death of his mother. He was afflicted by a cough, accompanied by incessant fever: all remedies that were applied were found ineffectual. He soon perceived that the disease was mortal; and considering all attempts to stop its progress as time lost, devoted himself unremittingly to the completion of some of the works which he had commenced.

M. Corvoisart having advised him to pass a winter at Nice, he conceived himself bound to yield, and was much benefited by the journey; and the mildness of the climate appeared in some degree to have restored his health. Whilst at Nice, he gave himself up to study with fresh vigour, passing whole

days in a boat out at sea, collecting moluscæ and fish; and it was only that he might not afflict his friend Lesueur, who accompanied him, that he consented to return when exposed to danger of a recurrence of his disorder, from the wet and cold. The letters he wrote to his friends whilst at Nice shew how enthusiastically he was devoted to science.* Nevertheless, the transitory relief he enjoyed, did not deceive him as to the real state of his health, and he flattered himself merely with the hope that he had a few months respite; and these he well employed. The collection and observations he made at Nice are extremely valuable.

When he returned to Paris, his health soon became worse than when he quitted it. I saw him frequently, observes M. Deleuze, and sought to inspire him with hope; but he had none:—he spoke of his end with perfect calmness; and on a sick bed, he contemplated the approach of death with the same even courage with which he had so often braved it in the field; amidst the tempests of the sea; or amongst the savage inhabitants of inhospitable shores.

As his illness increased, he felt a desire to end his days where they had began, and in the arms of his sisters, who had been the objects of his earliest affections. He bade a solemn and a last farewell to all his friends, and set off for Cerilly, where he resigned himself to the advice and prescriptions of his friends, the inability of which, however, he was well aware of.

By the direction of his old friend and fellow-student, M. Bonnet, his bed was placed in a cow-house, and whenever he required any sustenance, either his sisters or Lesueur fed him

* In proof of this we give an extract from a letter written to M. Freycinet, who was employed in the geographical part of the voyage:

"Never, I protest to you, my dear F——, have I worked more than at the present moment; and so does Lesueur. The instant we rise we begin our labours, and break off to take our scanty meal with regret. But for the frightful torments which afflict me, I never was more happy or contented. Of this I assure you, on my honour—and this I call real existence; for I know no one pleasure so great as that which arises from useful and honourable occupation. Seeing your friend, thus near the grave, apply himself so unremittingly to science, will, I doubt not, animate you with the most generous courage to persevere in your own labours!—"

with new milk: he was surrounded by the beings whom he best loved. In order to prevent his exhausting himself by speaking, his friend Lesueur read to him constantly, except whilst he slept. He preserved to the last moment of his life that eager desire for knowledge which he had manifested from his earliest youth. As his end approached, all his impatience and irritability passed away; and the only subject that continued to interest him was, the welfare of his poor and unprotected sisters, whom he was about to quit for ever. His strength became quite exhausted, and during the night of the 14th of December, 1810, having received from his friend a small quantity of milk which he had asked of him, pressed his hand, and expired!

We have entirely abstained in the foregoing notice from entering into the question respecting the misrepresentation contained in the first volume of M. Péron's work, which was calculated to rob the ill-fated Captain Flinders of the merit of his discoveries. It seems to be generally admitted that M. Péron was controlled in this respect by an *over-ruling authority*; and Flinders himself has not scrupled to testify his belief that his candour was equal to his acknowledged abilities. Both these meritorious travellers now rest in an early grave, and were alike snatched away before they were in full possestsion of the applause and admiration to which they were so well entitled, on account of their devotion to the cause of science.

Though we are willing to acquit M. Péron of all share of the attempt to rob Flinders of the merit of his hard-earned labours, yet we should be sorry to omit an opportunity of testifying our detestation of the base and narrow policy which led to the detention of the unfortunate navigator at the Isle of France. Though this short-sighted manœuvre has been completely frustrated, and brought shame on its contrivers, its victim died heart broken, and worn out by disease, which had its origin in his cruel captivity. We shall again observe on this subject, in a short account of the life of Captain Flinders, which we propose to lay before our readers in the next Number of this Journal.

Art. IX. *On the Coniferous Plants of* Kæmpfer. *By* R. A. Salisbury, *Esq. F. R. S. &c. In a Letter to the Editor.*

Dear Sir,

I have lately been examining all the plants I could meet with, belonging to the natural class of Coniferæ; and among others, those preserved in the British Museum, which were collected by Kæmpfer, in Japan, about 120 years ago. His descriptions excel many that are published in our days, under far more favourable circumstances; and as we have already a number of these plants in the gardens about *London*, and shall probably soon see more from *China*, I presume the following information respecting them, may just now be acceptable to several readers of your Journal. I shall take these plants as they stand in Kæmpfer's *Amœnitates Exoticæ*, giving his names first, and references to his Herbarium, MS. figures, and MS. descriptions, for the convenience of any one who wishes to consult them, adding some observations of my own, and a few which were communicated to me by the late learned botanist, Mr. Dryander.

1. *Na*, vulgo *Nági*, item *Tsíkkura Séba.* Laurus julifera, folio specioso enervi. *Kæmpf. Amœn. p.* 773, *cum. Ic. ad p.* (errore typographi) 874. *Herb. fol.* 41, *et* 63. *Figg. MSS. p.* 92, 93, *et* 119. Myrica Nagi, *Thunb. Fl. Jap. p.* 76. Nageia Japonica, *Pers. Syn.* 2. *p.* 614.

This is a charming fragrant evergreen, of slow growth, but in time as large as a *Cherry* tree; and so much esteemed in *Japan*, that it is brought from the woods, and planted in the gutters of their streets, as it is an aquatic. Thunberg has referred it to *Myrica*; but I think there can be no doubt of its belonging to *Coniferæ*, though I have never seen its fructification, the specimens in Kæmpfer's Herbarium being without any. Mr. Robert Brown, however, has been more fortunate, and given some information respecting it to that excellent carpologist Richard. whose work upon the subject will soon appear. Persoon makes a distinct genus of it;

in my opinion, very properly; but he seems to have no idea of its affinity, still placing it after *Myrica*, notwithstanding Kæmpfer expressly says, that it has "nucleum individuum, apiculo, qui medium verticilli instar pervadit," which is one of the essential characters of *Coniferæ*. In a natural series, it comes very close to *Podocarpus*, but from Kæmpfer's MS. drawings of the fruit, I cannot join it to that genus, from which it likewise differs in habit

2. *Ken Sin*, item *Sen Baku*, vulgo *Inu máki*, i. e. *Máki spuria*. *Kæmpf. Amœn. p.* 780. *Herb. fol.* 24. Taxus Verticillata. *Thunb. Fl. Jap. p.* 276.

A very curious tree, growing conically, like a *Cypress*, but with totally different leaves, which are narrow, verticillated, and two or three inches long. "No flowers or fruit on Kæmpfer's specimen; but from his short description, it cannot be a *Taxus*, and is most probably a *Podocarpus*."—Dryand.

3. *Sin*, vulgo *Máki*, seu *Fon Máki*, id est *Máki legitima*. *Kæmpf. Amœn. p.* 780. *Herb. fol.* 25. *n.* 1. *Figg. MSS. p.* 13. *Ic. Select. t.* 24. Taxus Macrophylla. *Thunb. Fl. Jap. p.* 276.

This is no doubt a congener of the preceding, and Kæmpfer himself says so; it becomes a large tree, and the wood is so light and durable, as to be in great request for cabinets. Neither of them have been yet brought to this country.

4. *Ginkgo*, vel *Gín an*, vulgo *Itsio*. Arbor nucifera folio Adiantino. *Kæmpf. Amœn. p.* 811. *cum Ic. Figg. MSS. p.* 91. Ginkgo. *Linn. Mant. p.* 303. Salisburia Adiantifolia. *Smith in Linn. Trans.* 3. *p.* 330.

This singular tree produces male flowers most abundantly in *Kew* garden every year, but no females; which, however, I am informed by Professor De Candolle, have been seen at *Geneva*: so that its immediate affinity in the class cannot be long unknown. I suspect that its fruit will prove reversed, or turned down, like that of *Nagia* and *Podocarpus*.

5. *Fi*, vulgo *Kajá*. Taxus Nucifera. *Kæmpf. Amœn. p.* 814. *cum Ic. Herb. foll.* 10, 21, *et* 22. *Figg. MSS. p.* 217.

A large tree very similar to our common *Yew* in habit; but perfectly sui generis. In a work I am now printing, I have

called it after Henry Lyte, Esq. of *Lyte's Carey*, in *Somersetshire*, who translated Dodoen's Herbal into our native tongue, and died in 1607. It was introduced here many years ago by Gilbert Slater, Esq. who sent me a few female flowers, which it produced in his green-house; but I fear it is now lost, the plant which is sold by our nurserymen, and inserted in the Hortus Kewensis, for it, being very different.

6. *Sjo*, vulgo *Maatz*. *Kæmpf. Amæn. p.* 883.

"No specimen or description in his MSS. answering to this name, nor did I expect to find any, as he says it is only the *Japanese* generic name for different species of *Pinus*. Thunberg, however, quotes it for *Pinus Sylvestris* L."—Dryand.

7. *Sĕosi*, vulgo *Kara maatz Nomi*. Larix conifera, nucleis pyramidatis, foliis deciduis. *Kæmpf. Amæn. p.* 883. *Herb. fol.* 25. *Figg MSS. p.* 218. *Descr. MS. p.* 137, ubi *Gojono Maatz* audit.

No flowers or fruit on the specimen, but as the leaves are 5-na in a sheath, it cannot be a genuine *Larix*. I have a suspicion that it is Thunberg's *Pinus Cembra*.

8. *Moro*, al. *Sonoro maatz*. Juniperus arborescens, baccis Sabinæ. *Kæmpf. Amæn. p.* 883. *Herb. fol.* 11. et in aliis foliis.

A species of tree *Juniper*, which I think is very distinct from *Communis* L. The ticket in p. 11, has upon it, in Kæmpfer's own hand-writing, *Fi Moro*, aliis *Moro*, aliis *Sonoro Maatz*, aliis *Fusi Maatz*. In his description, he says, that it is a shrub about Meaco, but in other places becomes a tree.

9. *San* vulgo *Ssugi*. Cupresso-Pinolus resinifera, fructu sphærali squamoso, pruni magnitudinis; seminibus paucis oblongis, compressis, striatis, spadiceis. *Kæmpf. Amæn. p.* 883. *Herb. fol.* 7. *Descr. MS. p.* 138. *Figg. MSS. p.* 129. *Ic. Select. t.* 48.

Only a female branch of this has been drawn by Kæmpfer, and published by Sir Joseph Banks, in the work last quoted.

There is a male branch, however, in his Herbarium, which, together with the perfect fruit in *Soho Square*, leaves no doubt that it constitutes a distinct genus, which I have called *Abela*, after the zealous naturalist now gone to *China* in the English embassy. It forms a large tree, and in Gronovius's Herbarium is called *Speerboom*.

10. *Nankin Ssugi.* Juniperus Bermudiana. *H. Bat. Herm.* quæ ex Regni Sinæ provincia *Nankin* invecta, ob pulchritudinem colitur. *Kæmpf. Amæn. p.* 884. *Herb. fol.* 7. *n.* 2. *Figg. MSS. p.* 129, *n.* 3. *Descr. MS. p.* 89.

Another species of *Abela*, with glaucous leaves, which has long been cultivated in our green-houses, and I have no doubt will succeed in the open air. Kæmpfer departs a little from his usual accuracy in quoting Herman's plant, which came from America, and is the *Juniperus Bermudiana* L. for his. Besides this, we have a third species of *Abela* here, with green leaves, which is hardy, and cultivated by Mr. Joseph Knight, at Little Chelsea; they all resemble the *Deciduous Cypress* in habit, and are likely to prove very ornamental.

11. *Ssugi bjakkusi*, aliis *Tatsi bjakkusi*. Arbuscula foliis musci terrestris acuminatis. *Kæmpf. Amæn. p.* 884. *Herb. fol.* 10. *n.* 3.

No figure or description. The specimen is a male branch of the *Juniperus* above mentioned under *Moro*.

12. *Faijo Ssugi.* Sabino similis arbor paucarum orgyiarum: cymis in gemmas squamosas strobulis simillimas desinentibus. *Kæmpf. Amæn. p.* 884. *Herb. fol.* 6. *n.* 1 *et* 4.

No figure or description. The specimens are male branches of *Sabina Chinensis*, now thriving in the open air at *Kew*, with all the leaves squamose.

13. *Jempak*, vulgo *Ibuki.* Juniperus arbor Cupressi facie, odore partium tetrico Sabinæ. *Kæmpf. Amæn. p.* 884. *Figg. MSS. p.* 129, *f.* 2. *Descr. MS. p.* 135.

There are neither flowers nor fruit upon the specimen, but it is very like the *Juniperus Daurica* of Pallas, which rare shrub is at *Kew*, and in Mr. Lambert's collection at *Boyton*.

Both these plants may be distinguished by having their lower leaves squamose, and the upper leaves elongated and spreading; whereas, in all the others of the Order, which produce two sorts of leaves, the first and lower leaves, are the most perfect; and KÆMPFER has carefully noted this singularity.

14. *Quai*, vulgo *Fi no ki et Ibuki*. Cupressus succo imbuta pingui viscido aromatico, odorem Juniperinum spirante, fructu verrucoso parvulo, pisi magnitudinis. *Kæmf. Amœn. p.* 884. *Herb. fol.* 8. *n.* 1. Thuia Dolabrata. *Linn. Suppl. p.* 420.

A very imperfect fruit of this remarkable tree has merely enabled me to say it is no *Thuia*; but there are better specimens of the following plant, which, from its habit, is evidently a congener: in both the leaves are apparently 3-lobed, the branch lying concealed between the two leaves which form the middle lobe, and the deception is rendered more complete, by one half of the side leaves, and that whole middle leaf, which look towards the earth, being glaucous, and performing, no doubt, the office of an under surface. Accordingly, I have named this genus *Dolophyllum*.

15. *Fi noki* altera. Cupressus vulgaris nostras, foliorum odore balsamico; fructu ut plurimum quina semina, tritici grano similia, continente. *Kæmpf. Amœn. p.* 884. *Herb. fol.* 6. *n.* 3. *Figg. MSS. p.* 130, *n.* 2. *Descr. MS. p.* 135. *n.* 2.

A species of *Dolophyllum*, with smaller and much sharper leaves. By a note of KÆMPFER's, it appears, that *Fi no ki*, means a tree with leaves whitish or gray on the under surface; but *Konoto-Gasjiwa* a tree with leaves alike on both surfaces.

16. *Konoto-Gasjiwa. Kæmpf. Herb. fol.* 6. *n.* 2. *Figg. MSS. p.* 130. *Descr. MS. p.* 35. Thuia Orientalis. *Linn. Sp. Pl. ed.* 2. *p.* 1422.

"I cannot believe that the seeds and capsules of this shrub belong to the same genus with *Thuia Occidentalis*, however similar in habit."—DRYAND. There are other differences also in the fructification and male flowers, which prove Mr. DRYANDER's sagacity, and confirm the propriety of separating

them, but he thought this ought only to be done in a work on the whole Order, or rather Class; for I consider Coniferæ as a very extensive Natural Class, containing 6 Orders, viz. *Cycadēæ, Dacrydēæ, Cupressēæ, Laricinēæ, Eutassēæ, Ephedrēæ.*

17. *Asjinarŭ*, an arbor vitæ, aliter *Sowara no ki.* Kæmpf. Herb. foll. 7. et 19.

Both the specimens are now almost rotten, but when I examined them with Mr. Dryander at the time the *Icones Selectæ* were published, a few branches remained perfect, and corresponded minutely to that variety of *Thuia Orientalis*, now in our gardens, with rounder and smoother fruit.

R. A. SALISBURY.

18, *Queen-street, Edgeware-road,*
20th Sept. 1816.

Art. X. *Some Account of the meteoric Stones, in the Imperial Museum at Vienna. Communicated by Dr.* Noehden.

The mineralogical collection of the Imperial Museum at Vienna, is among the richest and most splendid in Europe. It contains objects of uncommon value, and beauty, and is altogether highly deserving the attention of the curious traveller. I visited it in June, 1815; my leisure, however, did not permit me so particularly to examine it, as to give any minute account of its general arrangement, or of the rare and valuable natural curiosities which are to be found in it—nor had I an opportunity of comparing it in these respects with the various British and Foreign collections which I had before visited. One of the first objects, however, that presented itself to my observation, was a glass case containing a superb series of meteoric stones; of these I shall give a short account in this Paper. I was struck with their number and variety, and with the uncommon size of one or two of them. One, which was found at Elbogen, in Bohemia, weighed two hundred weight. I had always considered that found by Mr. Topham in York-

shire, and now in the possession of Mr. Sowerby, as very large: at least, I had seen none that exceeded it in magnitude. But as it weighs little more than fifty pounds, it equals only the *fourth* part of that of Elbogen; and nearly all have some historical notices attached to them, as well as some account of the phænomena which attended their descent from the atmosphere; a circumstance too frequently neglected in collections of this kind, and which renders the present assemblage highly interesting and instructive. The specimens, which are nineteen in number, are as follows:

No. 1. A large stone from Agram in Croatia, which fell May 26, 1751, at 6 o'clock p. m. It is not smooth, or even, on the outside, but has depressions and protuberances.

No. 2. The large specimen from Elbogen, in Bohemia, before mentioned. There is no date to this. It weighed originally two hundred weight: but a piece has been cut off at one of the corners, perhaps the fifth part of the whole, for the purpose of manufacturing the iron it contained. Of the latter, several instruments were made, as curiosities, such as a garden-knife, pen-knife, a pair of scissars, and a magnetic needle. One or two of these articles are in the possession of the Emperor of Austria. What the quality of the meteoric iron, for such purposes, exactly is, I cannot pretend to say; but Mr. Sowerby caused, about three years ago, an elegant sword to be manufactured of that material, which was intended as a present for the Emperor of Russia. The inside of the Elbogen stone has a sort of waved, or damasked appearance, which perhaps arises from a peculiar crystalline texture of the iron.

No. 3. Specimen from Krasnojarsk in Siberia.

No. 4. Specimen from Neuhof, between Leipzig, and Grimma, in Saxony.

No. 5. Specimen from Collina and Brianza, in Italy, near Milan.

No. 6. Specimen from Tucuman, near St. Jago del Estero, in Peru.

No. 7. Specimen from Barbotam, in Gascony, (Departement des Landes, in France). Fell July 24, 1790, at 9 o'clock, p. m.

No. 8. Specimen from Toluca, near Durango, in Mexico.

No. 9. Specimen from Weston, in Connecticut, North America. Fell December 14, 1807, at 6 o'clock, a. m.

No. 10. Specimen from Tabor, in Bohemia. Fell July 3, 1753, at 8 o'clock, p. m.

No. 11. Specimen from Aigle in Normandy. Fell April 26, 1803, at 1 o'clock, p. m.

No. 12. Specimen from Lissa, in Bohemia. Fell September 3, 1808, at ½ past 3 o'clock, p. m.

No. 13. Specimen from Ensisheim, in Alsace. Fell November 7, 1492, at noon.

No. 14. Specimen from Eichstedt, in Franconia. Fell February 19, 1785, the hour not known.

No. 15. Specimen from Mauerkirchen, in Bavaria. Fell November 20, 1768, at 4 o'clock, p. m.

No. 16. Specimen from Casignano, near Parma and Placenza, in Italy. Fell April 19, 1808, at 1 o'clock, p. m.

No. 17. Specimen from Benares, in the East Indies. Fell December 19, 1798, at 8 o'clock, p. m.

No. 18. Specimen from Smolensk, in Russia. Fell March 13, 1807, in the afternoon.

No. 19. Specimen from Stannern, near Iglau, in Moravia. Fell May 22, 1808, at 6 o'clock, a. m.

Of several of the foregoing specimens, there are duplicates in the collection; for example, a great many of No. 19; so that the Museum may, by exchanging, if an opportunity offer, increase the number of specimens.

Most of the above specimens have been analysed, and Mr. Mühlfeld, the keeper of the Mineralogical collection, offered, with great politeness, to communicate what information he possessed, upon that subject. My departure from Vienna prevented my availing myself in person of this offer, but I requested a friend of mine to apply for that communication. Mr. Mühlfeld, accordingly permitted him to copy the Papers on which the analyses alluded to, were recorded. This transcript I here subjoin, having translated it from the German into English.

Analysis of the meteoric Stones at Vienna.

No. 1. Analysed by Klaproth.

Native iron	96,50
Native nickel	3,50

No. 2. By Klaproth, and Neumann.

Native iron	97,5
Nickel	2,5

In repeating the analysis upon another piece, Klaproth found nickel 5,03; and Neumann, in another, nickel 5,32.

No. 3. By Klaproth.

(*a.*) *Substance resembling olivin.*

Silica	41
Magnesia	38,5
Oxide of iron	18,5

Howard, in 1802, gives this analysis.

Silica	27
Magnesia	13½
Oxide of iron	8½
Oxide of nickel . . .	½

(*b.*) *Olivin.*

Silica	27
Magnesia	25
Oxide of iron	23

(*c.*) *Iron.*

Containing 17 per cent. of nickel.

No. 5. Klaproth.

Not a vestige of nickel.

No. 6. Person who analysed it, not mentioned.

Iron	62 grains
Nickel	7½ ditto.

No. 7. Analyst not mentioned.

Silica	46
Magnesia	15
Lime	2
Oxide of iron	38
Oxide of nickel	2

No. 8. By Klaproth.

Iron	96,75
Nickle	3,25

No. 9. By Professor Cilleman, of Connecticut.

Silica	51,5
Magnetic oxide of iron .	38
Magnesia	13
Oxide of nickel	1,5
Sulphur	1,

No. 10. By Howard, Vauquelin, Mayer.

(*a.*) *Mineral substance.*

		Howard. Vauquelin.			Mayer.
Silica . .	25		Silica . .	45,45	
Magnesia .	9½		Magnesia .	17,27	
Oxide of iron	23½		Oxide of iron	42,72	
Oxide of nickel	1½		Oxide of nickel	2,72	

(*b.*) *Native iron.*

Iron	12½
Nickel	1½

No. 11. Fourcroy, Vauquelin, Thenard.

		Fourcroy Vauquelin			Thenard
Silica . . .	53		Silica . .	46	
Magnesia . .	2		Magnesia .	10	
Lime . . .	1		Lime . .		
Oxide of iron	36		Oxide of iron	45	
Oxide of nickel	3		Oxide of nickel	2	
Sulphur . .	2		Sulphur . .	5	

No. 12. Analyst not mentioned.

Silica	73
Alumine	1,25
Magnesia	22
Lime	0,50
Iron	29
Nickel	0,50
Manganese	0,25
Sulphur and loss . . .	3,50
	100

No. 13. By Bartholdy, Fourcroy, Vauquelin.

		Bartholdy 1800.			Fourcroy Vauquelin
Sulphur . .	2		Silica . .	56	
Iron	20		Magnesia .	12	
Magnesia .	14		Lime . .	1,4	
Alumine . .	17		Oxide of iron	30	
Lime . . .	2		Oxide of nickel	2,4	
Silica . . .	42		Sulphur . .	3,5	

No. 14. By Klaproth.

Native iron	19,
Nickel	1,50
Oxide of manganese	16,50
Magnesia	21,50
Silica	37,

No. 15. By Imhof.

Silica	25,4
Magnesia	28,75
Metallic iron	2,23
Metallic nickel	1,2
Oxide of Manganese	40,24
Sulphur	2,08

No. 16. By Guidotti, Professor of Natural History, and Chemistry, at Parma.

Silica	50,
Oxide of iron	28,
Magnesia	19,
Oxide of nickel	2,59
Oxide of manganese	1,50
Oxide of chrome, and sulphur	4,

No. 17. Name of the analyst not mentioned.

(*a.*) *Principal substance.*

Silica	48
Magnesia	18
Oxide of iron	34
Oxide of nickel	$2\frac{1}{2}$

(*b.*) *Metallic substance.*

Iron	17
Nickel	6

(*e.*) *Globules.*

Silica	50
Magnesia	15
Oxide of iron	34
Oxide of nickel	$2\frac{1}{2}$

(*d.*) *External*

Iron and nickel almost in a metallic state.

(*e.*) *Sulphuret of iron.*

Sulphur	2
Iron	10½
Nickel	1
Loss	½

No. 18. Analyst not mentioned.

Metallic iron	17,60
Metallic nickel . . .	0,40
Silica	38,
Magnesia	14,25
Alumine	1,
Lime	0,75
Oxide of iron	25,
Sulphuret of Manganese	3,

No. 19. By Moser, Chemist and Apothecary, at Vienna.

Silica	46,25
Lime	12,12
Alumine	7,62
Magnesia	2,50
Black oxide of iron . .	27,
Oxide of Manganese . .	0,75
Chrome	a vestige.

It deserves to be mentioned, that Professor Stromeyer of Gottingen, well known as one of the ablest chemists, and most accurate observers, in Germany, is at present engaged in an analysis of meteoric stones: and the result of his experiments and investigations will, undoubtedly, prove interesting.

Art. XI. *An Account of some Experiments on the* Ergot *of Rye, found in the* Bois de Boulogne, *near Paris.—By Mons.* Vauquelin, *Member of the Royal Institute of France. In a Letter from Dr.* Granville *to the Editor.*

My Dear Sir,

The account you have given in the last Number of your Journal of the use of clavus, or the *ergot* of rye, in medicine, taken from an American Journal, may perhaps induce some of the

members of the medical profession to try the action of that substance on the human system, in order to verify the statement of Dr. Bigelow of Boston. Should they prove correct, the materia medica will have made a most important acquisition. To assist them, therefore, and to guide them in their researches on this interesting subject, I have requested Monsieur Vauquelin's permission to transmit to you, for insertion in your next Number, a detailed account of some analytical experiments made on a very recent occasion by that eminent chemist, on the *ergot* in question, The experiments I allude to were undertaken in consequence of a report ordered by the Academy of Sciences, on a note of Mons. Virey, wherein he asserted, that the *ergot* was not, as De Candolle asserts, a champignon—a *sclerotium;* but a morbid modification of the grain of the rye itself. The report has since been read before the Institute by Mons. Desfontaines; and the conclusions, as you will learn from the proceedings of that illustrious body during the last quarter, have been, to the astonishment of many, not only contradictory to the assertions of the author of that note, but also in opposition to Vauquelin's results. Of course it is not my business to inquire into the reasons of these discordant inferences: the writer of the Report himself gave none which could obviate the force of the arguments brought against him—may we not then continue to consider, as heretofore, notwithstanding Mons. De Candolle's opinion, the *ergot* as a disease of the rye, produced by a certain cause, and not as a parasitic plant?

Of Vauquelin's experiments, some he has had the goodness to permit me to witness; which has given me a new opportunity of appreciating the general accuracy, and the extensive knowledge, of that excellent chemist, whose good qualities are particularly enhanced by a high degree of modesty and liberality.

You will forgive me this small tribute of friendship.

M. Vauquelin intends shortly to publish his analysis in the "Annales du Musée d'Histoire Naturelle."

Physical Properties of the Ergot.

Colour. Externally, violet—internally, white.

Form. Cylindrical, gently tapering at the two extremities, curved in the form of a crescent—with a longitudinal streak on the convex as well as the concave side.*

Dimensions. Six or eight lines in length—from two to three in its greatest diameter.

Flavour. At first imperceptible; but after some time, acrid and disagreeable.

Observations. A grain of the ergot cut transversely, and seen through the microscope, presented an assemblage of small and brilliant grains like starch. The external and coloured pellicle, seen under similar circumstances, appeared as a mass of a violet colour, strewed with small whitish spots.

The colouring matter of the ergot may be obtained by means of boiling alcohol, acting upon the dry and pulverized substance. The alcohol after a short time becomes of a dark red, a little inclined to violet. Heated with boiling water, and under the same circumstances, the ergot yields a beautiful violet-red colour—not so intense, however, as that obtained with alcohol. A very diluted solution of carbonate of potash, employed in the same manner, assumed a deep wine-red colour, which became more intense on application of heat. The acetic acid extracted no colour any way remarkable—the sulphuric acid was coloured red, but slightly—so was the muriatic acid, but more intensely—the tartaric acid, on the contrary, assumed a pale rose colour—and finally, the nitric acid destroyed the natural colour of the substance, by turning it yellow.

Water and alcohol, therefore, seem to be the real solvents of the colouring matter; especially the former.

Chemical Properties of, and Experiments with, the Aqueous Solution of Ergot, &c.

It reddens litmus paper, precipitates the acetate of lead of a lilac colour—lime water of a light blue, while the liquid

* See Fig. 3, Plate VIII.

remains of a rose colour—and acetate of iron of a blueish grey. When a little alcohol is added to the solution, and vinegar is used as a re-agent, the liquid remains of a rose colour, while the precipitate is of a purple red.

Experiments.

1st. Two ounces of the ergot, dried and pulverized, were treated with boiling water till the latter ceased to become coloured. This aqueous decoction was troubled by the tincture of galls, and the solution of chlorine in water. Evaporated and reduced to a consistent form, it gave an extract of a brown-red colour, having a taste, at first sweetish, but afterwards bitter and nauseous; it reddened litmus paper strongly; yet when triturated with caustic potash in an agate mortar, it emitted a strong smell of ammonia.

2d. The ergot, which had been treated with boiling water as above, was next submitted to the action of boiling alcohol, which assumed a slight yellowish red colour during the operation; and the soluble matter was obtained by a subsequent distillation. This matter was of a greenish brown, had an acrid and a bitter taste—it reddened litmus paper, and became puffy when projected on red hot coals, emitting a strong smell like that of burned bread.

3d. After having thus tried the action of these two solvents on the original quantity of the *ergot*, the residue was divided into several smaller portions, one of which slightly coloured, a diluted solution of sub-carbonate of soda; while another, distilled in a small glass retort, gave for produce an oil, sensibly alcaline, and colouring the water with which it was agitated; of an acrid and bitter taste, emitting an ammoniacal smell when triturated with caustic potash; and leaving behind some carbonaceous matter yielding, after combustion, gray ashes chiefly composed of phosphate of lime and magnesia, together with a small quantity of iron.

4th. Twenty grammes (310 grains), treated with cold water, and afterwards distilled at a slow fire, gave a liquid sensibly alcaline, restoring the blue colour to litmus paper

previously reddened by an acid, turning the syrup of violets green, and forming a white precipitate with solutions of acetate of lead and nitrate of mercury.

5th. Another experiment was made on a fresh quantity of the ergot, to ascertain whether it contained any amylaceous matter (starch). The result was a coloured substance without any of the properties of starch; while the water employed in the operation, after having stood some days in a closed phial, emitted a strong smell of ammonia, mixed with that of putrified fish; the latter to a very intense degree.

6th. To obtain the resinous matter in its pure state, forty grammes of the ergot were treated with alcohol, which, when evaporated to the consistency of extract, gave a brownish red substance, having a rancid fishy taste. The distilled alcohol had a most insupportable smell of putrified fish. The extract, when placed on red hot coals, burned with a strong smell of tallow.

7th. From a distillation of 40 grammes of the ergot, without any addition, a thick oil was obtained, of a most nauseous smell, and sensibly alcaline. Some of this oil, put in contact and agitated with water, gave the latter the appearance and the feel of a concentrated solution of soap. The carbonaceous matter left in the retort weighed 7.700 grammes. The ergot had therefore lost in this distillation 32.300 grammes.

8th. Muriatic acid left in contact with the ergot for twenty-four hours assumed a deep purple colour.

Mons. Vauquelin extended his researches much further, and endeavoured to ascertain the real nature of the colouring principle in the ergot, which he applied to wool and silk; but for these I shall refer your readers to the Memoir Mons. Vauquelin intends publishing on this subject. I shall merely relate the conclusions derived from the above series of experiments.

It appears that the ergot contains

1st. A pale yellow colouring matter, soluble in alcohol, tasting like fish oil.

2dly. An oily matter.

3dly. A violet colouring matter, insoluble in alcohol, and easily applicable to wool and silk.

4thly. An acid, probably phosphoric.

5thly. A vegeto-animal matter, very abundant, and prone to putrefaction, yielding much thick oil, and ammonia, by distillation.

It would be easy, from the above experiments, to prove that the ergot is merely a degeneration of the grain of the rye, produced by external causes. The physical characters of the ergot, and the principles obtained by chemical means, serve to shew the nature of the disease. The amylaceous matter has been succeeded by a gelatinous substance, and the gluten has suffered certain modifications. Hence the opinion of Vauquelin, that the ergot is not a parasitic plant, is not only plausible, but more than probable. Yet to prove in a more evident manner the great difference existing between the ergot and the species of mushrooms to which De Candolle has assimilated it, some experiments on the latter were instituted by the same chemist, the result of which I am also happy to be able to send you.

It appears then, that when a given quantity of *sclerotium* is treated with boiling water, the latter is not in the least coloured, has a milky appearance, an insipid taste, and is precipitated by alcohol, by solution of chlorine, or the infusion of galls, under the form of white flocculi.

That the extract obtained by evaporation is of a yellowish brown, of a sweetish taste, and in appearance mucilaginous like that of mushrooms in general.

That the infusion is not acid—and the oil obtained by distillation is neither so abundant nor so dense as that of the ergot.

That the latter contains a fixed oil, ready formed; whereas the *sclerotium* contains no such principle—an observation which may be applied also to the free ammonia contained in the former.

There exists, therefore, a very material difference between the two productions in question.

That you may judge yourself of the physical characters of the ergot, I have sent you some specimens of it—and likewise some of the wool and silk dyed with one of its two colouring principles.

I nearly forgot to mention that when a grain of the ergot is inflamed by contact with a lighted candle, it burns with a white flame, distilling some drops of an oily liquid, emitting a dense black smoke, and smelling like burnt bread.

Your's truly,

A. B. GRANVILLE.

Paris, 1*st December.*

*** Having had opportunity of repeating and verifying many of the above results, we have thought it right to insert them in the present Number, as well as the conclusions of M. De Candolle. They are correct and curious, as far as relates to the chemical properties of the *spur:* but whether they demonstrate *that it is not a sclerotium*, is another question. The editor begs to refer to the Proceedings of the Royal Institute of France upon this subject.

ART. XII. *Transactions of the Batavian Society of Arts and Sciences. Vol.* VII.—(Batavia, 1814.)

IN our former Number, we noticed these Transactions, and furnished some extracts from the Discourse of Mr. Raffles, the President, to the Society.

It having been the policy of the Dutch, whilst in possession of Batavia, to conceal every thing relating to the country, the information which has, since its cession to England, been acquired, is particularly interesting.

As these Transactions are little known in Europe, and the Society is remarkable, by being the earliest literary society formed in the East, we shall give a short account of it up to the year 1811.

Previous to the establishment of the Batavian Society,

Mr. Radermacher, a gentleman of distinguished talents, in conjunction with a few friends at Batavia, conceived the idea of assembling together a number of persons of consideration and ability, with the view of encouraging the arts and sciences in the capital, and the other Indian establishments then dependent on Holland. They considered that in the East, as in Europe, where for two centuries the reformation in letters preceded that in religion, a taste for the arts and sciences must be introduced previously to the general adoption of the Christian religion; but they were aware of the difficulties to be encountered under the circumstances in which the colonies of Holland were then placed, and a considerable period elapsed before the design was carried into effect.

At length, in the year 1777, when Mr. Radermacher, and his father-in-law, the Governor General De Klerk, were newly elected directors of the Society of Haerlem, a programma appeared, which contained the plan of extending the branches of that Society to the Indies. The distance and extent of the Dutch colonial possessions did not, however, admit of this plan being realized, but the idea being thus brought forward to public notice, a separate Society was established at Batavia, by the unremitting perseverance of Mr. Radermacher,* who may be called the founder of the institution.

On the 24th of April 1778, this Society was duly established, under the authority of Government. On its first organization, it consisted of 192 members, the governor general being chief, and the members of the high regency directors. The ordinary members were elected from among the most distinguished inhabitants of Batavia, and the other possessions of the company.

The Society selected as objects of research and enquiry, whatever could be useful to agriculture, commerce, and the welfare of the colony; it encouraged every question relating to natural history, antiquities, and the manners and usages of the native inhabitants, but expressly avoided entering upon

any subject which might relate to the East India Company; and in order the better to define the objects, and contribute to their accomplishment, a programma was from time to time printed and circulated.

In 1779 the Society undertook to print the first volume of its Transactions; the second appeared in 1780, and the third in 1781; but from the want of types, and other unfortunate circumstances, a programma only appeared in 1782. In 1786, the 4th volume was however given to the public, but printed in Holland, by the commissaries of the Society, under the special privilege of the States general.

After this period, the Society observing that the questions proposed remained unanswered, set to work themselves, and published the 5th volume in 1790. In this and the 6th volume, which appeared in 1792, the essays are written exclusively by the members.

In 1794 the two first essays intended for the 7th volume were printed; but no subsequent publication of the transactions of the Society appears to have taken place.

Subsequently, when the revolutions in Europe, the war and other circumstances of the times, continued to interfere with the prosperity of the Society, a more limited plan for its proceedings was adopted.

Such was the state of the Society at the change of Government in 1811, when the dark perspective was illumined, and the talents and ambition of the Society again shone forth from the obscurity in which political circumstances had involved it.

We must refer our readers generally to the discourse of Mr. Raffles, which contains a very interesting view of the present state of knowledge respecting Java, and the countries in its vicinity.

With respect to the six first volumes, Mr. Raffles observes— they contain much useful and interesting information, particularly on economical subjects, materially connected with the interests of science and literature.

In the first volume will be found an interesting description of the Dutch possessions in the East Indies; and the transac-

tions are replete with various valuable tracts on agriculture, commerce, political economy, and natural history, by Messrs. Radermacher, Van Hogendorp, Hooyman, Van Iperen, Baron Van Wurmb, Couperus, Van der Steoge, Titsing, Tessiere, Van Boeckholtz, and others; and with regard to the contents of the present volume,* the papers by Dr. Horsefield are highly interesting to science. On the antiquities and natural history of the island, some light is thrown by Lieutenant Colonel Mackenzie, surveyor general on the Madras establishment, in his tract on the ruins of Prambana, forming the capital of one of the early dynasties of the Island of Java; and on the Island of Borneo, some interesting data are furnished from the pen of the late Dr. Leyden, on which to found further inquiries in that immense island.

Mr. Raffles, in the introductory discourse, observes—the first point which it appears essential to notice with regard to the future proceedings of the society, is the necessity of encouraging and attaining a more general knowledge of the

* CONTENTS.

I. Prize answer to the prize question of the society, on "the most proper food for young children, who are not suckled by their mothers or nurses." By Cornelis Terne, M. D. of Leyden.

II. Report on the manners and customs of the inhabitants of the Mountain Brama, with a history of their origin, according to an account from a letter from Mr. Adrian van Ryck.

III. Chemical analysis of a volcanic sand and iron ore. By T. Horsfield, M. D.

IV. Letter on the Solo river. By the same. Letter describing a tour to the eastern districts of Java. By the same.

V. Description of the Crinum asiaticum. By T. Horsfield, M. D.

VI. Description of the Gatip tree. By the same.

VII. Chemical analysis of the fruit of the Rarak tree. By the same.

VIII. On the Oopas, or poison tree of Java. By the same.

IX. Narrative of a journey to examine the remains of an ancient city and temples at Brambana, in Java. By Lieutenant Colonel Mackenzie.

X. Sketch of Borneo. By the late Dr. Leyden.

Javanese language. Hitherto the communication with inhabitants of the country, has been chiefly through illiterate interpreters, or when direct, though the medium of a barbarous dialect of Malays confounded and confused by the introduction of Portuguese and Dutch.

Vocabularies have already been collected of the different dialects of the Javanese, and also of the principal languages in the eastern seas; and from the unremitting and indefatigable exertions of Colonel Mackenzie, whose researches into the history and antiquities of Western India, so eminently qualify him for similar pursuits in this quarter, we are justified in the expectation, that many of the doubtful points regarding the early connection of Java and the eastern islands with the continent of India, will be cleared up.

It is to what has been emphatically termed the "Further East," that I would direct your more immediate attention; and here, if I am not mistaken, an ample field is afforded. The History of Sumatra, by Mr. Marsden, has thrown so clear a light on the country and character of the inhabitants, that I have but to refer you to that valuable work for all that is yet known respecting that interesting island. Much, however, still remains to be done, even in this quarter, and our recent connection with Palembang, and the southern provinces of the island, promises to afford every facility to our inquiries.

Of the chain of islands lying east of Java, and with it denominated generally the Sunda Islands, I shall only notice particularly that of Bali. This island lies so close to Java, that it is surprising so little is known of it. All accounts agree, that vestiges of the Hindu or B'hudist religion, perhaps of both, are still to be found. Some accounts go so far as to state, that in the interior of the country, the inhabitants are divided into four tribes, termed Bramana, Sudra, Wazier, and Sutra; and it is certain, that on the final establishment of the Mahomedan religion in Java, the Hindus or B'hudists who remained unconverted, took refuge in that island.

We have hitherto only adverted to the countries lying in the more immediate vicinity of Java, but in extending the

prospect and directing our views eastward to the other islands of the Archipelago, our attention is forcibly attracted by the great Island of Borneo, hitherto a blank on the chart of the world. From the best information we have yet been able to obtain of this immense island, greater in extent than any civilized nation of Europe, and abundantly rich in the most valuable natural productions, it would appear, that the whole country was, at no very remote period, divided under the three empires of Borneo, Sucadana, and Banjer Masin, of which the reigning princes of the two latter, trace their descent from Mah'japahit in Java.

Borneo or B'rni, now termed by us Borneo Proper, having been the first port visited by Europeans, may have given rise to the name of Borneo being erroneously applied to the whole island, which, by the native inhabitants, and universally by the eastern states, is termed Pulu K'lemantan.

It is impossible but to regret that circumstances have deprived this gentleman of the means he possessed, as governor of Java, of prosecuting the enquiries which he began, respecting these interesting and nearly unknown countries, and which he seems to have entered upon with a zeal and earnestness in the cause of science highly creditable to himself.

The singular imposition on the scientific world, respecting the Oopas tree, published in Holland in 1783, makes the account of Dr. Horsefield, given in this volume, particularly interesting.

The history and origin of this celebrated forgery still remain a mystery. Foersch, who put his name to the publication, was a surgeon in the Dutch East India Company's service. Having hastily picked up some vague information concerning the oopas, he carried it to Europe, where his notes were arranged, doubtless by a different hand, in such a form, as by their plausibility and appearance of truth, to be generally credited. It is in no small degree surprising that so palpable a falsehood should have been asserted with so much boldness, and have remained so long without refutation—or that a subject

of a nature so curious and so easily investigated, relating to its principal colony, should not have been enquired into, and corrected by the naturalists of the mother country.

To a person in any degree acquainted with the geography of the island, with the manners of the Princes of Java, and their relation to the Dutch Government at that period, or with its internal history during the last 50 years, the first glance at the account of Foersch must have evinced its falsity and misrepresentation.

But though the account just mentioned, in so far as relates to the situation of the poison tree, to its effects on the surrounding country, and to the application said to have been made of the oopas on criminals in different parts of the island, as well as the description of the poisonous substance itself, and its mode of collection, has been demonstrated to be an extravagant forgery,—the existence of a tree on Java, from whose sap a poison is prepared, equal in fatality, when thrown into the circulation, to the strongest animal poisons hitherto known, is a fact, which is fully established by the author of the present paper.

The tree which produces this poison is called antshar, and grows in the eastern extremity of the island.

The work of Rumphius contains a long account of the oopas, under the denomination of arbor toxicaria: the tree does not grow on Amboina, and his description was made from the information he obtained from Macassar.

His figure was drawn from a branch of that which was called the male tree, sent to him from the same place, and established the identity of the poison tree of Macassar and the other eastern islands with the antshar of Java.

The account of this author is too extensive to be abridged in this place; it concentrates all that has till lately been published on this subject. It is highly interesting, as it gives an account of the effects of the poisoned darts, formerly employed in the wars of the eastern islands, on the human system, and of the remedies by which their effect was counteracted and cured.

The simple sap of the arbor toxicaria, (according to Rum-

phius,) is harmless, and requires the addition of ginger and several substances analogous to it, to render it active and mortal. In so far, it agrees with the antshar, which, in its simple state, is supposed to be inert; and before being used as a poison, is subjected to a preparation, which will be described after the history of the tree. The same effervescence and boiling which occurs on the mixture of the substances added to the milky juice by the Javanese in Blambangan, has been observed in the preparation of the poison of Macassar, and in proportion to the violence of these effects the poison is supposed to be active.

Besides the true poison tree, the oopas of the eastern islands, and the antshar of the Javanese, Java produces a shrub, which, as far as observations have hitherto been made, is peculiar to the same, and by a different mode of preparation, furnishes a poison far exceeding the oopas in violence. Its name is tshettik.

The antshar is one of the largest trees in the forest of Java. The stem is cylindrical, perpendicular, and rises completely naked to the height of sixty, seventy, or eighty feet. It is covered with a whitish bark, slightly bursting in longitudinal furrows: near the ground this bark is, in old trees, more than half an inch thick, and, upon being wounded, yields plentifully the milky juice from which the celebrated poison is prepared. A puncture or incision being made in the tree, the juice or sap appears oozing out, of a yellowish colour; from old trees, paler: and nearly white from young ones: when exposed to the air, its surface becomes brown. The consistence very much resembles milk, only it is thicker, and viscid. This sap is contained in the true bark (or cortex,) which, when punctured, yields a considerable quantity, so that, in a short time, a cup full may be collected from a large tree.

Previous to the season of flowering, about the beginning of June, the tree sheds its leaves, which re-appear when the male flowers have completed the office of fecundation. It delights in a fertile and not very elevated soil, and is only found in the largest forests. Dr. H. first met with it (the antshar) in the province of Poegar, on his way to Banjoowangee. In

clearing the new grounds in the environs of Banjoowangee for cultivation, itis with much difficulty the inhabitants can be made to approach the tree, as they dread the cutaneous eruption which it is known to produce when newly cut down. But, except when the tree is largely wounded, or when it is felled, by which a large portion of the juice is disengaged, the effluvia of which mixing with the atmosphere, affect the persons exposed to it, with the symptoms just mentioned, the tree may be approached and ascended like the other common trees in the forests.

The antshar, Dr. H. observes, like the trees in its neighbourhood, is on all sides surrounded by shrubs and plants: in no instance have I observed the ground naked or barren in its immediate circumference.

The largest tree I met with in Blambangan was so closely environed by the common trees and shrubs of the forest in which it grew, that it was with difficulty I could approach it. And at the time I visited the tree, and collected the juice, I was forcibly struck with the egregious misrepresentation of Foersch. Several young trees spontaneously sprung from seeds that had fallen from the parent, reminding me of a line in Darwin's Botanic Garden,

"Chained at his root two scion Demons dwell."

While in re-calling his beautiful description of the oopas, my vicinity to the tree gave me reason to rejoice that it is founded on fiction.

The tshittik is a large winding shrub. In large individuals has a diameter of two or three inches, covered with a reddish brown bark, containing a juice of the same colour, of a peculiar pungent, and somewhat nauseous odour.

From this bark the poison is prepared.

It is very rarely met with, even in the wildernesses of Blambangan.

The process of preparing the antshar was performed for me by an old Javanese, who was celebrated for hissuperior skill in preparing the poison. About eight ounces of the juice of the antshar, which had been collected the preceding evening, in the usual manner, and preserved in the joint of a bamboo,

was carefully strained into a bowl. The sap of the following substances, which had been finely grated and bruised, was carefully expressed and poured into it, viz.—Arum, Nampoo, (Javanese), Kaemferia, Galanga, Kontshur, Amomum, Bengley, (a variety of zerumbed), common onion and garlic, of each about half a dram; the same quantity of finely powdered black pepper was then added, and the mixture stirred.

The preparer now took an entire fruit of the capsicum fruticosum or Guinea pepper, and having opened it, he carefully separated a single seed, and placed it on the fluid in the middle of the bowl.

The seed immediately began to reel round rapidly, now forming a regular circle, then darting towards the margin of the cup, with a perceptible commotion on the surface of the liquor, which continued about one minute. Being completely at rest, the same quantity of pepper was again added, and another seed of the capsicum laid on as before: a similar commotion took place in the fluid, but in a less degree, and the seed was carried round with diminished rapidity. The addition of the same quantity of pepper was repeated a third time, when a seed of the capsicum being carefully placed in the centre of the fluid, remained quiet, forming a regular circle about itself, in the fluid, resembling the halo of the moon. This is considered as a sign that the preparation of the poison is complete.

The tshettik is prepared by separating the bark of the root, and boiling it, and after separating the bark from the water, exposing the extract to the fire till it is about the consistence of syrop. After this, the preparation is the same as of the antshar.

An account of 26 experiments, is detailed by Dr. Horsefield, on which he remarks, that he has selected from a large number of experiments, those only which are particularly demonstrative of the effects of the antshar and of the tshettik, when introduced into the circulation. The poison was always applied by a pointed dart or arrow, made of bamboo.

The operation of the two different poisons on the animal system is essentially different.

The first 17 experiments were made with the antshar; the rapidity of its effect depends, in a great degree, on the size of the vessels wounded, and on the quantity of poison carried into the circulation.

In the first experiment, it induced death in 26 minutes,—in the second, in 13 minutes. The poison from different parts of the island has been found nearly equal in activity.

The common train of symptoms is, a trembling and shivering of the extremities, restlessness, discharges from the bowels, drooping and faintness, slight spasms and convulsions, hasty breathing, an increased flow of saliva, spasmodic contractions of the pectoral and abdominal muscles, retching, vomiting, excremental vomiting, frothy vomiting, great agony, laborious breathing, violent and repeated convulsions, death.

The effects are nearly the same on quadrupeds, in whatever part of the body the wound is made. It sometimes acts with so much force, that not all the symptoms enumerated are observed.

The oopas appears to affect different quadrupeds with nearly equal force, proportionate, in some degree, to their size and disposition. To dogs it proved mortal, in most experiments, within an hour. A mouse died in ten minutes; a monkey in seven minutes; a cat in fifteen minutes.

A buffalo, one of the largest quadrupeds of the island, died in two hours and ten minutes, though the quantity of poison introduced in this experiment was proportioned to that which was thrown into the system in the experiments on smaller animals.

If the simple or unprepared sap is mixed with the extract of tobacco or stramonium, (instead of the spices mentioned in the account of the preparation,) it is rendered equally, perhaps more active.

Even the pure juice, unmixed and unprepared, appears to act with a force equal to that which has undergone the preparative process, according to the manner of the Javanese at Blambagan.*

* We certainly were surprised at the Doctor's statement of the process of preparation which, in fact, seems to add nothing to the violence of the poison.

Birds are very differently affected by this poison. Fowls have a peculiar capacity to resist its effects. A fowl died 24 hours after the wound; others have recovered after being partially affected.

In regard the experiments made with the poison prepared from tshettik, its operation is far more violent and rapid than that of the antshar, and it affects the animal system in a different manner; while the antshar operates chiefly on the stomach, and alimentary canal, the respiration and circulation, the tshettik is determined to the brain and nervous system.*

A relative comparison of the appearances on dissection, demonstrates, in a striking manner, the peculiar operation of each.

After the previous symptoms of faintness, drowsiness, and slight convulsions, it acts by a sudden impulse, which, like a violent apoplexy, prostrates at once the whole nervous system.

In the two experiments, this sudden effect took place on the sixth minute after the wound; and in another, on the seventh minute, the animals suddenly started, fell down head foremost, and continued in convulsions till death ensued.

This poison affects fowls in a much more violent manner than that of the antshar, death having frequently occurred within the space of a minute after the puncture with a poisoned dart.

The simple unmixed decoction of the bark of the root of the tshettik, is nearly as active as the poison prepared according to the process above related.

The resinous portion of the bark is by no means so active as the particles soluble in water.

* Mr. Brodie, in a paper on vegetable poisons, (Phil. Trans. 1811,) has given an account of some experiments made by him, with the *upas antiar*, from Java, furnished by Mr. Marsden, from which it appears, that when inserted in a wound, it produces death, (as infusion of tobacco does, when injected into the intestines,) by rendering the heart insensible to the stimulus of the blood, and stopping the circulation.

Taken into the stomach of quadrupeds, the tshettik likewise acts as a most violent poison, but it requires about twice the period to produce the same effect which a wound produces; but the stomachs of fowls resist its operation.

The poison of the antshar does by no means act so violently on quadrupeds as that of the tshettik. Dr. H. observes he gave it to a dog; it produced at first nearly the same symptoms as a puncture; oppression of the head, twitchings, faintness, laborious respiration, violent contraction of the pectoral and abdominal muscles, an increased flow of saliva, vomiting, great restlessness and agony, &c. which continued nearly two hours; but after the complete evacuation of the stomach by vomiting, the animal gradually recovered.

Rumphius asserts, that a small quantity may be taken internally as a medicine.

In animals killed by the antshar, the large vessels in the thorax, the aörta and venæ cavæ, were, in every instance, found in an excessive degree of distension: the viscera in the vicinity of the source of circulation, especially the lungs, were uniformly filled in a preternatural degree with blood, which in this viscus, and in the aörta, still retained a florid colour, and was completely oxygenated. On puncturing these vessels, it bounded out with the elasticity and spring of life. The vessels of the liver, of the stomach, and intestines, and of the viscera of the abdomen in general, were also more than naturally distended, but not in the same degree as those of the breast. In the cavity of the abdomen, a small quantity of serum was sometimes effused.

The stomach was always distended with air, and in those instances in which the action of the poison was gradual, and in which vomiting supervened in the course of the symptoms, its internal coat was covered with froth.

The brain indicated less of the action of the poison, than the viscera of the thorax and abdomen. In some instances it was perfectly natural—in others, marks of a small degree of inflammation were discovered.

An undulatory motion of the skin, and of the divided muscles, was very evident in some of the dissected animals.

The appearances observed in the animals destroyed by the tshettik were very different. In a number of dissections, the viscera of the thorax and abdomen were found nearly in a natural state, and the large vessels of the thorax exhibited that condition in which they are usually found after death from other poisons.

But the brain and the dura mater shewed marks of a most violent and excessive affection. In some instances the inflammation and redness of the dura mater was so strong, that on first inspection, Dr. H. supposed it to be the consequence of a blow previously received, until he found, by repeated examinations, that this is a universal appearance after death from tshettik.

Rumphius had an opportunity of personally observing the effect of the poisoned darts or arrows on the human system, as they were used by the natives of Macassar, in their attack on Amboina, about the year 1650.

Speaking of their operation, he says, the poison touching the warm blood, is instantly carried through the whole body, so that it may be felt in all the veins, and causes an excessive burning, and violent turning in the head, which is followed by fainting and death.

After having proved mortal to many of the Dutch soldiers in Amboina and Macassar, they are said to have finally discovered an almost infallible remedy in the root of the Crinum asiaticum, (called by Rumphius, radix toxicaria), which, if timely applied, counteracted, by its violent emetic effect, the force of the oopas.

An intelligent Javanese informed Dr. Horsefield, that an inhabitant was wounded in a clandestine manner, by an arrow thrown from a blow pipe, in the fore arm, near the articulation of the elbow. In about fifteen minutes he became drowsy, after which he was seized with vomiting, became delirious, and in less than half an hour he died.

Dr. Leyden's Sketch of Borneo.

This paper contains much curious and new matter, and we regret that our limits will not admit of our giving any detailed account of its contents. The notices respecting the Dayak, which is the most numerous class of inhabitants, and probably the aborigines, are very curious. Their manners are characterized by some strange peculiarities and uncommon features of barbarism; but the spirit of these traits has never been elucidated, nor the system of religious or superstitious opinion with which they are connected, examined.

In appearance, the Dayak are fairer and handsomer than the Malays; they are of a more slender make, with higher foreheads and noses; their hair is long, straight, and coarse, generally cut short round their heads. The females are fair and handsome. Many of the Dayak have a rough scaly scurf on their skin, like the Jakong of the Malay peninsula. This they consider as an ornament, and are said to acquire it by rubbing the juice of some plant on their skin. The female slaves of this race which are found among the Malays have no appearance of it.

With regard to their funeral ceremonies, the corpse is placed in a coffin, and remains in the house till the son, the father, or the nearest of blood can procure or purchase a slave, who is beheaded at the time that the corpse is burnt, in order that he may become the slave of the deceased in the next world. The ashes of the deceased are then placed in an earthen urn, on which various figures are exhibited, and the head of the slave is dried, and prepared in a peculiar manner with camphor and drugs, and deposited near it. It is said that this practice often induces them to purchase a slave guilty of some capital crime, at five-fold his value, in order that they may be able to put him to death on such occasions.

With respect to marriage, the most brutal part of their customs is, that nobody can be permitted to marry till he can present a human head of some other tribe to his proposed bride, in which case she is not permitted to refuse him. It is not, however, necessary that this should be obtained entirely by

his own personal prowess. When a person is determined to go a head hunting, as it is very often a very dangerous service, he consults with his friends and acquaintances, who frequently accompany him, or send their slaves along with him. The head hunter then proceeds with his party in the most cautious manner to the vicinity of the villages of another tribe, and lies in ambush till they surprise some heedless unsuspecting wretch, who is instantly decapitated. Sometimes too, they surprise a solitary fisherman in a river, or on the shore, who undergoes the same fate. When the hunter returns, the whole village is filled with joy, and old and young, men and women, hurry out to meet him, and conduct him, with the sound of brazen cymbals, dancing in long lines to the house of the female he admires, whose family likewise comes out to greet him with dances, and provide him a seat, and give him meat and drink. He still holds the bloody head in his hand, and puts part of the food into its mouth, after which, the females of the family receive the head from him, which they hang up to the ceiling over the door.

If a man's wife die, he is not permitted to make proposals of marriage to another, till he has provided another head of a different tribe, as if to revenge the death of his deceased wife. The heads procured in this manner, they preserve with great care, and sometimes consult in divination. The religious opinions connected with this practice are by no means correctly understood. Some assert, that they believe that every person whom a man kills in this world, becomes his slave in the next. The Idaan, it is said, think that the entrance into Paradise is over a long tree, which serves for a bridge, over which it is impossible to pass without the assistance of a slave slain in this world.

The practice of stealing heads causes frequent wars among the different tribes of the Idaan. Many persons never can obtain a head, in which case they are generally despised by the warriors and the women. To such a height it is carried, however, that a person who had obtained eleven heads, has been seen by Mr. Burn, and he pointed out his son, a young lad, who had procured three.

We shall conclude this article, by the following extract, respecting the largest diamond yet known.

The most remarkable circumstance connected with Mattan is, that the Rajah possesses the finest and largest diamond in the world, which has hitherto been discovered. This diamond, which is said to be of the finest water, weighs 367 carats. The celebrated Pitt diamond weighs only 127 carats. The Mattan diamond is shaped like an egg, with an indented hollow near the smaller end. It was discovered at Landak about 90 years ago; and though the possession of it has occasioned numerous wars, it has been about 80 years in the possession of the Mattan family. Many years ago, the governor of Batavia sent a Mr. Stuvart to ascertain the weight, quality, and value of this diamond, and to endeavour to purchase it; and in this mission, he was accompanied by the present Sultan of Pontiana. After examining it, Mr. Stuvart offered 150,000 dollars for the diamond, the sum to which he was limited; and, in addition to this sum, two war brigs, with their guns and ammunition, together with a certain number of great guns, and a quantity of powder and shot. The Rajah, however, refused to deprive his family of so valuable a hereditary possession, to which the Malays attach the miraculous power of curing all kind of diseases, by means of the water in which it is dipped, and with which they imagine the fortune of the family is connected.

Art. XIII. *A Review of the Genus* Amaryllis. *By* John Bellenden Ker, *Esq.*

The group of species comprized under the generic appellation Amaryllis, is not surpassed in general splendour of inflorescence by any within the limits of the vegetable system. In these islands the genus is wholly exotic. Its first spontaneous appearance, in geographical relation to them, is in the southern-

most parts of Europe; but by few species, and with little lustre or variety. The throng and pomp of pageantry are only displayed within or on the borders of the tropics. In the northern states of America we know of only one species.

The present revisal of the genus was not suggested so much by the weight of any new matter we have to offer, as by the wish to concentrate information which as yet remains dispersed at unconnected points, and to render it more readily available to the student. The last general enumeration of AMARYLLIS, worthy of notice, is contained in a part of Willdenow's edition of the "Species Plantarum" printed as far back as 1799. Since that period new species have been discovered and recorded, others dismissed and assorted in more convenient groups, and a still greater portion illustrated which were before obscurely or imperfectly known.

We hear with pleasure that another edition of the Linnæan System of vegetables, augmented to the instant time by Drs. Roemer and Schulte, is nearly ready for the press.* An enterprize, by the by, that still defies the energy of our countrymen. We confess ourselves desirous that the recent acquisitions, now scattered in detached and miscellaneous works or straying in the labyrinth of preludes to a natural method, should be enrolled in the ingenious and ready system, to the use of which we have the most of us been disciplined.

Natura in reticulum sua genera connexit, non in catenam; homines non possunt nisi catenam sequi, cum non plura simul possunt sermone exponere. Haller helv. ii. 180.

AMARYLLIS.

Methodo Linnæano. Classis et Ordo. HEXANDRIA MONOGYNIA.
Methodo Naturali Jussieui. Divisio primaria. MONOCOTYLEDONES.

* This work is noticed in the account of new books given in another part of this Number, which may be referred to.

CLASSIS III. Stamina perigyna.

ORDO. NARCISSI. *Div.* II. Germen inferum.

——— AMARYLLIDEÆ. *Brown. prod. flor. nov. holl.* 296.
Sect. I. Radix Bulbosa. Flores spathacei, umbellati, rarò solitarii.

Conspectus generum divisionis ordinalis.

CALOSTEMMA. Germen uniloculare.

PANCRATIUM. Corona filamentorum connectilis.

NARCISSUS. Corona includens filamenta infra ejus basin intra tubum inserta.

AMARYLLIS. Limbus turbinato-patens. Filamenta libera summo tubo infra faucem inserta.

BRUNSVIGIA. Capsula clavato-turbinata, triquetra lobis compressis; oligosperma.

CYRTANTHUS. Corolla clavata limbo breviore fauce; filamenta fauci supra tubum inserta.

CRINUM. Corolla regularis hypocrateriformis.

HÆMANTHUS. Capsula baccata, loculis monospermis.

STRUMARIA. Stylus strumosus vel strictissimus et robustior.

LEUCOJUM. Antheræ apice dehiscentes.

GALANTHUS. Corolla laciniis petalodibus, 3 parvis emarginatis.

G E N U S.

AMARYLLIS. *Spatha* terminalis, bivalvis rariùs indivisa. *Flores* 1—multi, umbellati, *bracteis* distincti. *Corolla* erecta ad subcernuam, infundibuliformis ad hexapetalodi-rotatam; *limbo* profundiore fauce, sæpè irregulari. *Filamenta* glanduloso disco vel summo tubo infra faucem insita, erecto-divergentia ad fasciculato-declinata, profundiùs inclusa ad rarò subexserta. *Antheræ* introrsùm versæ, versatiles, sæpè vibratæ. *Germen* inferum; *loculamenta* collaterali-disperma ad cumulato-polysperma. *Stylus* inclinatus, curvatus. *Stigmata* 3 replicata vel 1 subtrifidum depressum

v. apertum. *Capsula* oblata, triloba lobis rotundatis, trilocularis, trivalvis valvis medio septigeris. *Semina* biseriata, globosa ad foliaceo-complanata, rarò subarillatìm immersa funiculo crasso fungoso, modò bulboso-laxata rariùs solitaria: *albumine* carnoso: *embryone* recto.

Bulbus *concentricè tunicatus.* Folia, 1 *ad plurima, bifaria ad multifaria, linearia ad petiolata cum laminâ oblongâ, scapi isocrona v. tardiora. Os tubi non rarò sertulo brevi membranoso fimbriatìm squamatìm v. alitèr fisso v. integerrimo arctè extra basin filamentorum cinctum. Haud nimìs faciendum limbi inflexio; cùm sæpè solùm directione corollæ pendat; umbellæ enim videndæ in periphæriâ nutante irregulariforæ, in centro erectiore regulariflora.*

Species.

I. *Uniflora.* *Spatha latere dehiscens.* *Folia bifaria.*

1. *colchiciflora.* A. foliis linearibus obliquè tortis lucidis; flore radicali, aphyllo, erecto: staminibus erectis.

Amaryllis colchiciflora. *nob. in Curt. Mag. fol.* 1089: *commutatâ synonymiâ cum sequente.*

Sternebergia colchiciflora. *Kitaib. et Wald. ic. pl. hung.* 2. *t.* 157. *Marshall von Bieberstein taur. caucas.* 1.261.

Narcissus autumnalis. *Clus. hist.* 1. 164. *cum ic.*

Luteâ minor. *Bulbus* pusillus ovatus, indusio, fusco. *Folia* vernalia, subquina, digitalia, lineâ parùm latiora, erecta, obtusa, carinata, planiuscula. *Flos* flavus, odoratus, autumnalis: *tubus* strictus, partim subterraneus, *limbo* longior. *Antheræ* 4-loculares. (*Kit.*) *Capsula* succrescente scapo extrusa humo, oblonga, subtrigona. *Semina* plura (5) in loculo, globosa, nigra, funiculo fungoso crasso albo subarillatè immersa.

Patria: Hungaria, Tauris.

2. *clusiana.* A. foliis loratis planis glaucissimis laxiùs spiraliobliquatis flore radicali, aphyllo, erecto: staminibus erectis.

Amaryllis clusiana. *nob. in Curt. Mag. fol.* 1089; (*commutatis cum antecedente synonymis.*)

Narcissus persicus. *Clus. hist.* 1. 163. *cum ic.*

Bulbus globoso-ovatus, indusio fuscescente. *Folia* vernalia, subquaterna, cæsia, lorata, plana, erecta. *Flos* autumnalis, ex flavo pallescens, odore ingrato viroso; laciniis externis limbi latioribus, hamato-mucronatis. *Stam.* alternè longiora. *Capsula* in brevi scapo emicans humo.

Clusio allata ex Constantinopoli.

3. *exigua.* A. foliis filiformibus; spatha acuta; tubo brevi; flore erecto: staminibus erectis.

Amaryllis exigua. *Schousboe maroc. part.* 1. 160. *edit. german. p.* 1. 146. *Roth neue beytrage.* 190. *Id. ann. of bot.* 2. 26.

Bulbus rotundo-ovatus, indusio fusco. *Scapus* teres tenuis digitalis. *Folia* 1-3 longitudine ferè scapi. *Spatha* 1-phylla longitudine pedicelli floris. *Corolla* lutea, erecta, campanulata tubo brevi, laciniis æqualibus lineari-lanceolatis, obtusis, nervo intensiùs flavescente per medium dorsum ducto. *Filamenta* subæqualia, fermè longitudine corollæ. *Stylus* filiformis.

Patria: ager tingitanus. Schousboe.

4. *citrina.* A. spatha indivisa obtusa; corolla subcampanulata erecta, laciniis linearibus emarginatis: stigmate trilobo. *Smith prodr. flor. græc.* 1. 221.

Amaryllis citrina. *Flor. græc. t.* 311.

Haud aliundè nobis nota. Tabula et descriptio ex Florâ Græcâ allegatæ nondum editæ.

Patria: Græcia. In monte Olono Peloponesi, sero autumno florens. S.

5. *lutea.* A. foliis pluribus carinatis; flore erecto, in scapo ancipiti sessili, laciniis ovali-oblongis obtusis: staminibus erectis.

Amaryllis lutea. *Linn. sp. pl. ed.* 2. 1. 420. *Hort. Kew.* 1. 415. *ed.* 2. 2. 223. *Curt. Magaz.* 290. *Willd. sp. pl.* 2. 50. *Redoutè liliac.* 148.

Narcissus Autumnalis major. *Clus. hist.* 164.

Bulbus globoso-ovatus, indusio nigricante. *Folia* 3-plura, lorata, canaliculata, atrovirentia, lucida, semunciam lata ultràve. *Scapus* brevis, anceps, robustior. *Corolla* lutea, subbiuncialis, turbinato-campanata, tubo vix $\frac{1}{3}$ partem limbi æquante, laciniis concaviusculis infernè versùs angustatis, extimis 3 ferè ex tertiâ parte latioribus; intimis cum fine rotundiore. *Stamina* adnata tubo, conniventia, $\frac{1}{4}$ breviora limbo, invicèm longiora: *antheræ* lineares, versatiles, luteæ. *Stigmata* obsoletè trina, inæqualia (anne constantèr?)

Habitat Europam Australem; Orientem.

II. *Uni-v. subuniflora. Spatha divisa v. subdivisa. Folia bifaria.*

6. ***chloroleuca.*** A. pedicellato-subbiflora; folio lineari; tubo brevissimo, limbi erecti laciniis apice rotundatis: staminibus erectis. *(Vide tab.* VIII. *fig.* 1.*)*

Amaryllis ochroleuca. *nob. (ex tabulâ in vol.* 1 "*Adumbrationum Francisci Bauer" in Mus. Banks.)*

Bulbus ovato-oblongus indusiis pullis, vix magnitudine ovi columbini. *Folium* unicum, semipedale, ligulato-lineare, planum, sublongius *scapo* viridi tereti. *Spatha* acuta pedicellis 1-sesquiuncialibus altior, valvis arrectis. *Germen* viride breve oblongum. *Corolla* chloroleuca cum striis externis obsoletè lateritiis, sesquiunciâ profundior, turbinato-campanata; tubo subnullo viridiusculo germinis continuo; *laciniis* obovato-oblongis, concaviusculis, mucronulatis. *Stam.* fundo corollæ inserta, erecto-conniventia, alternè longiora, ex tertiâ parte breviora limbo: *antheræ* pallidæ. *Stylus* æquans corollam: *stigmata* replicata. Nobis tantùm ex tabulâ Domini Francisci Bauer in Museo Banksiano, ad plantam vivam Horto Kewensi floridam adumbratâ notà. Hanc quondam perperàm habuimus pro AMARYLLIDE *Pumilione.*

Nescimus patriam.

7. *Pumilio.* A. flore sessili, folio lineari unico; laciniis tubo longioribus, ovato-oblongis, reflexis, acutis: staminibus inclinatis.

Amaryllis Pumilio. *Hort. Kew.* 1. 415. *ed.* 2. 2. 223. *Willd. sp. pl.* 2. 50.

Folium infernè angustatum. *Scapus* teres, palmaris, virescens. *Flos* erectus. *Spathæ* foliola lineari-subulata, basi invicèm amplexa, tubo corollæ longiora, virentia. *Corollæ* tubus infundibuliformis uncialis albidus externè lineis sex elevatis notatus, internè lineis sex rubris cum prioribus alternantibus. *Limbus* extùs albidus intùs lateritius. *Filamenta* inclinata, filiformia, tubo infrà faucem inserta, apice inflexa albida, 3 alterna breviora. *Antheræ* oblongæ incumbentes luteæ. *Germen* oblongum, *Stylus* filiformis albidus; *stigma* trifidum, laciniæ lineares rubicundæ apice albæ. *Linn. fil. in Hort. Kew.*

Patria: Africa Australis; Caput Bonæ Spei.

8. *pudica.* A. 1-flora; corolla subregulari, erectiuscula, turbinato-campanulata, subconnivente, lacinia una staminibus inclinatis retrusa. (*Vid. tab.* VIII. *fig.* 2.)

Amaryllis pudica. *Ex tabulâ ad plantam anno* 1785 *in H. R. Kewensi floridam à Dom. R. A. Salisbury egregiè depictâ.*

Bulbus non visus, neque *folia;* hæc tardiora flore. *Scapus* humilis. *Spatha* 2-valvis, erecta, acuminata. *Corolla* biuncialis ultràve, albo-rubescens; *tubus* vix semuncialis, crassus, sexsulcus; *limbus* ad tubum usque partitus, laciniis elongato-lanceolatis, subæqualibus, acuminatis, striâ intensiùs rubente secundùm medium dorsum ductâ notatis, imbricato-conniventibus, præter unicam fasciculo staminum inclinantium pressam retrocedentem. *Stamina* breviora limbo. *Stigmata* 3, inclusa. Exemplarium habetur in Herbario Banksiano itidem Horto Kewensi floridum, omnibus consentiens cum præsenti plantâ præterquam flore sessili, non pedicellato.

Patria: Caput Bonæ Spei. Masson adduxit.

9. *tubispatha.* A. foliis paucis ligulato-linearibus; spatha 1-

phylla vaginante erecta bifida, bis breviore pedicello; corolla regulari, subnutante: tubo subnullo.

Amaryllis tubispatha. *L'Heritier sert. angl.* 9. *Willd. sp. pl.* 2. 51. *Nob. in Curt. magaz.* 1586. *cum tab.*

Bulbus subglobosus indusio fusco. *Folia* subtrina, 1—2 lineas lata, obtusula, subæquantia *scapum* (nunc binos) compresso-teretem spithamæum striatum fistulosum. *Spatha* cylindracea, sphacelata, acuminata, segmentis oppositis. *Pedicellus* teres erectus, flori subodorato æqualis. *Germen* oblatum, cylindraceum, rotundatè trilobum, trisulcum, viride, loculis polyspermis. *Corolla* nascens cum aliquo rubore suffusa, adulta candicans, de medio circà infernè versùs virens, turbinato-vel cunei-formi-campanulata at angustius et contractiùs, subbiuncialis, laciniis infrà brevissimè connexis oblongis, deorsùm attenuatis, laminâ ellipticâ rectiore brevè acuminatâ; *exterioribus* penè bis latioribus, imbricato-complectentibus *interiores* subbreviores. *Stamina* duplo breviora limbo, brevissimè adnata, laxè fasciculata, declinata: *antheræ* pallidæ, lineares, versatiles. *Stylus* longior, at inclusus: *stigmata* replicata. *Semina* rotunda nigra.

Patria: America meridionalis, Buenos Ayres. Jamaica? in montibus.

10. *Atamasco.* A. foliis pluribus ligulatis infernè attenuatis spatha bifida includente pedicellum; corollæ erectæ laciniis acuminatis: staminibus erectis.

Amaryllis Atamasco. *Linn. sp. pl. ed.* 2. 1. 420. *L'Heritier sert. angl.* 10. *Hort. Kew.* 1. 416. *ed.* 2. 2. 223. *Curt. magaz.* 239. *Redouté liliac.* 31. (var. minor.) 454. *Willd. sp. pl.* 2. 51. *Pursh amer. sept.* 1. 222. *Schkuhr botan. handb. t.* 90.

Lilio-narcissus virginiensis. *Catesby carol.* 3. 12. *t.* 12.

Narcissus virgineus. *Parkins. paradis.* 89. *fig.* 1.

Bulbus ovato-oblongus indusio fusco. *Corolla* magnitudine varia, albida, junior plus magis effusa rubore purpureo vel carneo præsertim ad tubum et per medium dorsum laciniarum; tubus brevis, laciniæ limbi lanceolatæ re-

curvo-patentes, infrà turbinato-contractæ. *Stamina* erecto-patentia, subæqualia, plurimùm breviora limbo. *Scapus* teres semipedalis ad pedalem; non robustus. *Sem.* rotunda; anguloso-pressa, nigra.

Patria: Carolina, Virginia.

III. *Subunifloræ. Tubus coronatus. Folia bifaria.*

10. *minima.* A. (tubo squamato) uniflora; limbo campanulato, æquali, subroseo: staminibus erectis. *Kunth.*

Amaryllis minima. *Humboldt et Bonpland nov. gen. et sp. plant. amer. æquin. à Kunth. v.* 1. *p.* 221.

Bulbus ovatus magnitudine cerasi minoris. *Folia* linearia, obtusa, plana, striatula paulò breviora scapo. *Scapus* teres pollicaris. *Spatha* (indivisa?) acuminata, basi inflata, striata, tenuissima, albida, flore duplo brevior. *Corolla* erecta alba vel rosea; tubo cylindraceo; limbo sexpartito. *Germen* 3-quetrum. *Stigmata* 3. Kunth. *Patria: Mexico, in temperatis humidis Novæ Hispaniæ juxta Real del monte et Cerro ventoso.* H. et B.

11. *nervosa.* A. (tubo squamato) pedicellato-uniflora; limbo campanulato æquali albo, laciniis ovato-oblongis, acutis, nervosis: staminibus erectis. *Kunth.*

Amaryllis nervosa. *Humboldt et Bonpland nov. gen. et sp. pl. amer. æquin. à Kunth. v.* 1. *p.* 221.

Bulbus non visus. *Folia* angustissima, linearia, plana, striata, glabra, 10—11-pollicaria. *Scapus* 6—8-pollicaris, teres. *Spatha* vix striata, oblongo-lanceolata, acuminata tenuissima, (indivisa?), subpollicaris. *Flos* sesquipollicaris, inodorus. *Pedicellus* teres, spatham vix superans. Laciniis *limbi* sexpartiti basi viridibus. Stamina alternè breviora. *Germen* subglobosum, 3-gonum. *Stylus* staminibus longior. *Stigmata* 3. *Semina* bulbiformia. *Kunth.*

Patria: Mexico, in convallibus araguensibus provinciæ caracasanæ juxta Cura, villam Comitis de Tovar. H. et B.

12. *tubiflora.* A. (tubo sertato ?) subbifolia, foliis ligulato-attenuatis; flore sessili in scapo.

Amaryllis tubiflora. *L'Heritier sert. angl.* 10. *Willd. sp. pl.* 2. 51.

Lilio-Narcissus croceus monanthos. *Feuilleé peruv.* 3. 29. *t.* 20.

Flos sessilis, croceus, triuncialis, infundibuliformis, recurvo-patens. *Scapus* pedalis. *Folia* 2 ligulato-acuminata, 9 uncias longa, 3 lineas lata.

Habitat Peru circà Lima. Feuillée.

13. *flammea.* A. (tubo squamato) corollæ laciniis semiconvolutis supernè patentibus reflexis, genitalibus brevibus erectis. R. et P.

Amaryllis flammea. *Ruiz et Pavon flor. peruv.* 3. 56. *t.* 286. *f. b.*

Lilio-narcissus monanthos coccineus. *Feuillée peruv.* 3. 29. *t.* 21.

Scapus pedalis. *Folium* unum ligulatum acuminatum carinatum, brevius scapo: post florescentiam folia plura consimilia. *Spatha* pedicellato-1-flora, decidua, appressa, lanceolata. *Corolla* flammeo-coccinea: *tubus* brevis: *limbus* bipollicaris, cylindraceo-campanulatus, fauce turbinatus, indè recurvo-patens, intùs ore tubi *squamis* parvulis membranosis crenulatis cinctus. *Filamenta* erecta, $\frac{1}{3}$ parte breviora limbo, flammea. *Stylus* flammeus; *stigmata* 3, replicata.

Patria: Peru. Ruiz et Pavon.

14. *peruviana.* A. (tubo squamato) corolla campanulata patentiuscula, staminibus erectis, stylo declinato; bulbo bulbillis obvallato. R. et P. (*sub aureâ.*)

Amaryllis peruviana, *nob. in Curt. Mag. fol.* 1089. *Poiret suppl. encyc. Lamarck* 1. 315.

Amaryllis aurea. *Ruiz et Pavon flor. peruv.* 3. 56. *t.* 286. *f. a.*

Bulbus rotundus indusio nigro nitido. *Folia* plura (5) ligulato-attenuata, carinata, acuminata. *Flos* peduncu

latus, coloris aurei, cylindraceo-infundibuliformis; tubo brevi in faucem turbinatam ampliato; limbo recurvo-patente. *Filamenta* erecta, æqualia. *Stylus* declinatus. *Faux* cincta squamis denticulatis membranaceis. Præcedenti simillima species.

Patria: Peru. R. *et* P.

15. *maculata.* A. spatha lineari, flore pedunculato, genitalibus declinatis. *L'Heritier sert. angl.* 10.

Amaryllis maculata. *Willd. sp. pl.* 2. 52.

Scapus punctis lineatis maculatus. *Corolla* campanulata. *L'Herit.*

Habitat in Chili. Dombey.

16. *formosissima.* A. (tubo fimbriato) corolla nutante, rictu difformi divaricato: staminibus infernè per imi labii tubuloso-involutas lacinias complexis.

Amaryllis formosissima. *Linn. sp. pl. ed.* 2. 1. 420. *Curtis Magaz.* 47. *Redouté liliac.* 5. *Willd. sp. pl.* 2. 52. *Hort. Kew.* 1. 416. *ed.* 2. 2. 224.

Lilio-Narcissus jacobæus, flore sanguineo nutante. *Dillen. hort. eltham.* 195. *t.* 162. *f.* 196.

Spreikelia Heisteri. *Trew flor. imag. t.* 24.

Narcissus latifolius indicus rubro flore. *Clus. hist.* 2. 157.

Bulbus indusio nigricante. *Folia* plura lorato-elongata, angustiora, canaliculata, margini et carinâ tactui scabriuscula, infrà nervosa. *Scapus* fusco-rubens, vix æquans folia. *Spatha* bivalvis foliolo uno lineari incluso, altero folliculoso bifido, altiore *pedicello* crasso. *Flos* e majusculis, puniceus, micans, inodorus. *Corollæ tubo* brevissimo, membranaceâ fimbriâ coronato; *limbo* infernè breviùs arctato, indè dispanso in rictum biformem, *laciniis* lanceolatis longiùs acuminatis nervosis infrà angustatis; tribus *labii summi* stellato-divergentibus, mediâ erectâ, binis lateralibus oppositis; tribus *imi* propendulis, infrà in tubum trigonum convolutis indè explicatoribus. *Filamenta* rubra, fasciculata, corollæ æqualia, tubulo fermè obsoleto adnata, secundùm laci-

niam imam deflexa, apice incurvata; *antheræ* luteæ incumbentes, vibratiles. *Stylus* filiformis robustus ruber; *stigmata* 3 replicata, antheras exsuperantia.

Patria: America Meridionalis.

IV. *Bi-multifloræ. Tubus coronatus. Folia bifaria.*

17. *aulica.* A. tubo coronato membranâ brevi integrâ virente.

Amaryllis aulica. *nob.*

Incerti sumus de loco hujus speciei. Florem Horto regio Kewensi carptum unicâ tantùm vice et fugitivo visu præteritâ æstate conspeximus. Ut memoria verò est, flos solitarius, majusculus, irregularis, coccineo-splendens, tubi membranâ simili AMARYLLIDIS *calyptratæ* sed viridi. Vix ejusdem speciei varietas?

Patria: Brasilia.

18. *calyptrata.* A. (membranâ tubi decolori integrâ) pedunculato-biflora; limbo semiringente, nutante, laciniis extimis apice incurvo-conniventibus, intimis recurvo-divaricantibus.

Amaryllis calyptrata. *nob. in Botanical Register.* v. 2. 164, *cum tab.*

Folia coriaceo-firma, erecto-patentia, lanceolato-lorata, acuta, clathrato-venosa, 2 pedes cum dimidio longa, escunciam ad duas uncias usque lata. *Scapus* (modò plures successivi) triplo crassior pollice, parùm brevior foliis, estriatus, glaucus, basi purpurascens. *Flores* maximi, diutini, 5-unciales, subflavido-virentes, modò punctis minutis densis lateritiis striatìm confluentibus rubricati; *pedunculi* parùm germine longiores, calamum crassi. *Germen* unciale obesius pedunculo, exsulcum. *Corollæ* rictus transversìm latior; *tubus* rectus bis brevior limbo, germini subisoperimeter, intensiùs virens; *limbus* infrà imbricatus, clathrato-venosus laciniis lanceolatis acutis, undulatis, subæqualibus, exterioribus 3 dorso gibbosioribus, summâ mediâ antrorsùm depressâ, arcuatâ. *Stamina* exserta, fasciculata, declinata, subrubentia;

antheræ violaceæ, polline flavo. *Stylus* crassior, longior: *stigmata* revoluta. *Capsula* oblata-ovata, triventri triloba, suprà arctata, lobis pulvinato-rotundis suprà gibbis ventre decurvo-tumido. *Semina* latere interiori invicèm incumbentia, fumosa, foliaceo-complanata, elliptico-oblonga, unciam longa, alâ latissimâ; *nucleo* juxta marginem supernam posito.

Patria: Brasilia.

19. *chilensis.* **A.** (tubo squamato) subbiflora; foliis pluribus linearibus; spatha pedunculis longiore; tubo brevi: squamis faucialibus 3-4-fidis.

Amaryllis chilensis. *L'Heritier sert. angl.* 11. (*amandato synonymo Feuillæi ad* flammeam.) *Ruiz et Pavon flor. peruv.* 5. 56; *absque icone.*

Bulbus subrotundus. *Folia* linearia, utrinque attenuata, compressa, obsoletè lineata, carne spongiosâ favosâ. *Scapus* pedalis, teres, cavus, purpurascens, rariùs uniflorus. *Spatha* albido-rosea. *Corolla* bipollicaris, tubus brevis, luteus, limbus aurantiacus, laciniis lanceolatis patulis. *Filamenta* declinata, dimidio breviora corollâ. *Decerptè ex Ruiz et Pavon.*

Patria: Chili, Peru. Colonis, Hamanca encarnado.

20. *equestris.* **A.** (tubo fimbriato) 2-3-flora, pedicellis spatha erecta brevioribus, tubo filiformi horizontali, limbo obliquè patulo, sursùm curvo. *Hort. Kew.* 1. 417.

Amaryllis equestris. *Jacq. hort. schoenb.* 1. 33. *t.* 63. *Curt. Magaz.* 305. *Willd. sp. pl.* 2. 54. *Redouté liliac.* 32. *Hort. Kew. ed.* 2. 2. 224; *(excluso synonymo Andrews's reposit.* 358. 1; reginæ *allocando)*

Amaryllis dubia. *Linn. amœn. acad.* 8. 254.

Lilium americanum puniceo flore Belladonna dictum. *Herm. parad.* 194. *t.* 194.

Lilium rubicundum. *Merian surinam. t.* 22.

Folia subquaterna, lorata, utrinque attenuata, unciam ad summum lata, breviora *scapo* pedali tereti fistuloso

glauco. *Flores* inodori, subtriunciales, miniati; *faux* patens stellâ chloroleucâ. *Tubus* subuncialis calamum crassus. *Limbus* rictû obliquo divaricans. *Stamina* fasciculata, declinata.

Patria: America meridionalis; Barbada.

21. *miniata.* A. (tubo fimbriato) 2-4-flora, corolla ringente cernua, tubo brevissimo.

Amaryllis miniata. *Ruiz et Pavon.* 3. 57; *flor. peruv. absque icone.*

Folia lorata, utrinque attenuata. *Scapus* (nunc 3) glaucus cavus. *Flores* subtripollicares, pedunculati, incarnato-miniati: *faux* patens stellâ viridi-albâ: *tubus* vix trilinearis; *lacinia* suprema reflexa, ima angustior. *Stamina* declinata. *Bulbus* sectus aere expositus minii acquirit colorem. Separamus præcedente ob corollam cernuam dictam et tubum trilinearem: in *equestri* tubus subuncialis, corolla nutans.

Patria: Peru.

22. *reginæ.* A. (tubo fimbriato) 2-4-flora, foliis paucis loratis acuminatis, costâ carinatis, corolla subcernua, profundè turbinata, supra campanulato-subringente: tubo brevi, crasso.

Amaryllis reginæ. *L'Heritier sert. angl.* 12. *Hort. Kew.* 1. 416. *ed.* 2. 2. 224. *Curt. Magaz.* 453. *Willd. sp. pl.* 2. 3. *Redouté liliac.* 9.

Amaryllis brasiliensis. *Andrews's reposit.* 358.

Scapus (nunc bini) duplo brevior foliis, vix pedalis, subcompressus. *Flores* inodori, subquaterni, rarò plures; *pedicellis* brevioribus *spathâ* erectâ. *Corolla* triuncialis magisve, coccinea, *fauce* chloroleuco stellata; *laciniis* elongato-ovalibus, lanceolatis, infernè angustatis, e tubo vix longiore germine turbinato-divergentibus in campanam latam non revolutam. *Stamina* coccinea, parùm breviora limbo, declinata. *Folia* non glauca.

Patria: America meridionalis.

23. *advena*. A. (tubo fimbriato) pluriflora; foliis 1-pluribus lineari-ligulatis involutis glauciusculis; pedunculis subæqualibus corollæ nutanti bilabiato-divaricatæ; laciniis lingulato-lanceolatis, remotis.

Amaryllis advena. *nob. in Curt. Mag.* 1125; *cum tab. Hort. Kew. ed.* 2. 2. 225.

Lilio-Narcissus polyanthos, flore internè rubro, intùs luteo et rubro vario. *Feuillée peruv.* 3 30. *t.* 21.

Bulbus subrotundus, indusio nigricante. *Folia* 1—6, involuto-concava, dorso rotundata, obtusula, tertiam partem unciæ circitèr lata, longiora subbipedalia. *Scapus* compresso-teres, calamo anserino vix crassior, folia subæquans. *Flores* 4—5, subbiunciales, miniati, extùs virore suffusi, intùs ad faucem flavo-striati. *Spatha* sphacelata, lineari-lanceolata. *Corollæ tubus* brevis subæqualis germini, melle impletus; *limbus* in duo consimilia labia æquabilitèr dispansus; *laciniæ* utriusque labii radiato-distantes recurvæ, externæ 3 sublatiores, mucronatæ. *Filamenta* ¼ breviora limbo, fasciculata, declinata, supernè rubra alternè plurimùm breviora; *antheræ* flavæ vibratiles, lunulatæ. *Stylus* triquetro-filiformis, supernè versùs sensìm crassior; *stigmata* replicata, canaliculato-linearia.

Patria: Chili.

24. *bicolor*. A. (tubo bicorni-squamato) multiflora; foliis lorato-acuminatis; tubo brevi, laciniis lanceolatis erectis, supernè patulis.

Amaryllis bicolor. *Ruiz et Pavon. flor. peruv.* 3. 57; *absque Icone.*

Folia erecto-patentia. *Scapus* anceps. *Corolla* sesquipollicaris subcampanulata, rubra, apice virens. *Squamæ tubi* bicornes. *Filamenta* erecta. *Capsula* trigona. *Semina* nigra.

Patria: Peru. Ruiz et Pavon.

V. ***Bi-multiflora. Tubus nudus. Folia bifaria.***

25. ***reticulata*. A. pluriflora: foliis pluribus, lorato-oblongis, infernè versùs involuto-attenuatis; corolla subcernua longè cucullato-tubulosa; limbo obliquè ringente.**

Amaryllis reticulata. *L'Heritier sert. angl.* 12. *Hort. Kew.* 1. 417. *ed.* 2. 2. 225. *Andrews's reposit.* 179. *Thompson's bot. displ.* 7. *Redouté liliac.* 424. *Curt. mag.* 657.

β major; foliis striâ mediâ longtudinali argenteo-candicante à supino pictis.

Bulbus rotundus indusio pullo. *Folia* 4—5, intensè viridia, 7—9-uncialia, unam ad sesquiunciam lata, involuta, costâ mediâ carinata, acuta. *Scapus* glaucus, subcompressus, parùm supra semipedalem. *Flores* 4—5, 4—5-pollicares, pedunculati. *Corolla* lilacino-punicans, clathrato-venosa, fauce albicans; tubùs ultra unciam longus, deindè angustè turbinatus; limbi labium summum reflexum; laciniæ ovali-lanceolatæ. *Germen* subcoloratum, oblongum, rotundatè trigonum. β. seminibus sata, persistit.

Patria: Brasilia, Rio Janeiro.

26. *crocata.* A. pluriflora; spatha sphacelata pedicellis vix æquali; corollâ subcernuâ, inæquali, divaricato-ringente, tubo subæquante germen; laciniâ summâ remotâ, cæteris imam duplo angustiorem versùs obliquatis.

Amaryllis crocata. *nob. in Botanical Register; vol.* 1. 38. *cum tab.*

Bulbus indusio pallidè fusco. *Folia* plura, lorata-lanceolata fine obtuso, striata, lineolis interruptè cancellata, sesquipedalia, latiora vix 2 uncias transversè, non glauca. *Scapus* cæsius, bipedalis, pollice crassior, columnaris, basi purpurascens. *Spatha* reflexa, striata, sub- quadriflora. *Pedunculi* biunciales. *Germen* viride oblongum obtusè trigonum, crassius ferèque longius tubo virente: *ovula* numerosa, cumulata, complanata. *Corolla* subquadriuncialis, crocata, venis parallelis striata; *faux* brevis, turbinato-aperta, intùs stellata radiis senis chloroleucis rhombeo-lanceolatis; *limbus* radiato-reflexus, *laciniæ* ovali-lanceolatæ, laxiùs undulatæ, suprema remota, quasi per se pro labio habenda, laterales superiores supernè latere utroque reflexæ; ima obtusa. *Stamina* decli-

nata, alternè longiora, ¼ circiter breviora limbo. *Stigmata* profundiùs discreta, alba. *Semina* foliaceo-complanata.

Patria : Brasilia.

27. *rutila.* A. subbiflora; spathâ aridâ reflexâ, sublongiore pedunculis; limbo turbinato-bilabiato, rictu radiato obliquo, laciniis 3 summis conniventibus recurvis, infimis 3 porrecto-divergentibus: imâ angustâ, remotâ.

Amaryllis rutila. *nob. in Botanical Register; v* 1.23; *cum tab.*

Bulbus subrotundus, maculis miniatis sæpè pictus. *Folia* 3-plurima, sublanceolato-lorata, subpedalia, infra unciam lata. *Scapus* nunc foliis lateralis, compresso-teres, pennam olorinam crassus, glaucus, pedalis. *Germen* oblongum, obtusè trigonum, bis brevius tubo: *ovula* numerosa cumulata complanata. *Corolla* ferè quadriuncialis, miniato-micans, stellâ fauciali chloroleucâ sexradiatâ hians; tubus semuncialis trigonus germini isoperimeter; laciniis elongato-lanceolatis, exterioribus latioribus, lateralibus 2 summis supremam versus obliquatis: infimâ lineari-lanceolatâ. *Filamenta* declinata, miniata, longiora ⅓ breviora limbo, alterna plurimùm breviora. *Antheræ* luteæ, vibratiles. *Stylus* miniatus; *stigmata* alba, profundiùs replicata. *Equestri* et *miniatæ* propinquissima; fauce nudâ utrisque diversa.

Patria : Brasilia, circà pagum S^ti Pauli.

28. *blanda.* A. foliis plurimis oblongo-loratis obtusis; pedunculis divaricatis, æqualibus flori: tubo brevi turbinato; limbo recurvo-patente, obscurè bilabiato, nutante, subundulato.

Amaryllis blanda. *nob. in Curt. magaz.* 1450; *cum tab.*

Bulbus nunc ovo olorino duplo major, indusio pallido-fuscescente. *Folia* scapo tardiora, extima 2 breviora lanceolato-oblonga; interiora lorata lanceolata, acumine obtuso brevi, lætè viridia, nitida, costâ mediâ pallidiore carinata, tripedalia, latitudine sesqui-biunciali. *Scapus* 3-pedalis robustus. *Flores* plurimi, quadriunciales, turbinato-cam-

panati, infernè flavescentes indè ex albo incarnati, inodori, *pedunculis* viridibus, crassis, strictis. *Germen* obovatum, rotundatè trigonum, subduplo brevius tubo. *Corolla* è tubo brevi turbinato recurvo-patentissima, fauce pallidè flavescens, laciniis ovali-lanceolatis laxiùs undulatis, infernè versùs angustatis. *Stamina* fasciculata, declinata, ex unâ quartâ parte breviora limbo; *antheræ* luteæ incumbentes, vibratæ, demùm lunulatæ. *Stigma* depressum, subtrigonum.

Patria: Caput Bonæ Spei.

29. *Belladonna.* A. pedicellato-multiflora; foliis ligulatis canaliculatis, corollâ subregulari, turbinato-campanulatâ, nutante, nusquam flexâ, laciniis suprà recurvis; tubo subnullo.

Amaryllis Belladonna. *Linn. sp. pl.* 1. 421. *L'Heritier sert. angl.* 12. *J. Miller illustr. Hort. Kew.* 1. 417. *ed.* 2. 2. 225. *Nobis in Curt. magaz.* 733. *Willd. sp. pl.* 2. 54. *Redouté liliac.* 180; (*exclusis passìm Sloane, Herman, Seba, Merian, et Swartz* equestrem *intelligentibus*).

Lilionarcissus indicus fl. elegantissime purpurascente. *Weinm. Phyt.* 3. 276. *t.* 653. *fig. A.*

Narcissus polyanthos liliacino flore. *Rudbeck Elys.* 2. 48 *fig.* 7; (*figura Ferrarii*).

Narcissus indicus liliaceus diluto colore purpurascens. *Ferrarius floril.* 117. *t.* 121.

β.) minor; pallidiore flore.

Amaryllis pallida. *Redouté liliac.* 470.

Bulbus sæpè ovo olorino major, indusiis fibroso-membranaceis, intergerino plexû bombycino-fibroso, ductili. *Folia* plura, angustiùs lorata, fusco-virentia, 7-10-uncialia, vix tres partes unciæ lata, diù tardiora floribus. *Scapus* aphyllus, longior foliis, sæpiùs purpurascens, compressus, solidus. *Spatha* duplo longior *pedunculis* coloratis, cum *germine* concolori clavato-continuis. *Flores* triunciales ultràve, fragrantes, albido-rosei. *Corollæ* laciniis oblongo-lanceolatis deorsùm attenuatis longiùs imbricatis basi

tantùm concretis, exterioribus latioribus margine omninò liberis. *Filamenta* fasciculata, declinata, $\frac{1}{3}$ parte breviora corollâ, inæqualia: *antheræ* vibratæ. *Stigmata* lobuli breves intensè rosei. *Semina* pauca, magna, subglobosa.

Patria: India Occidentalis, docente Hort. Kew. Nonne potiùs Caput Bonæ Spei? Certò inde β.

30. *vittata.* A. corolla cucullato-campanulata; laciniis externis usque ad basin liberis, internis margine pro tertiâ ferè parte adnatis costæ intùs prominenti externarum.

Amaryllis vittata, *Hort. Kew.* 1. 418. *ed.* 2. 2. 225. *Curt. magaz.* 129. *Willd. sp. pl.* 2. 55. *Schneevoogt ic.* 14. *Redouté liliac.* 10.

Bulbus subrotundus, radiculis crassis carnosis. *Folia* 6—7 ultràve, erecto-recurvanda, lorata, breviora scapo, 1—2-uncias lata, obtusiuscula, medio canaliculata. *Scapus* (nunc bini) cylindricus, fistulosus, glaucus, 2—3-pedalis, duplo crassior pollice. *Flores* speciosi, plures ad plurimos, odoratissimi, pedicellati, horizontali-nutantes; *pedicelli* duplo breviores flore magìsve, fistulosi. *Corolla* 3—4-uncialis albida intùs vittis roseis picta, infernè versùs in cucullum longum angustum obsoletè trigonum sensim attenuata; limbus patens recurvatus, ferè regularis, subæqualis: laciniæ lanceolatæ, crispæ, infrà angustatæ, extimæ parùm latiores, uncinato—mucronatæ. *Filamenta* inserta puncto ubi ungues laciniarum intùs cæperunt cohærere in tubum, declinata, subæqualia, fasciculata, unâ quartâ parte breviora limbo. *Germen* obtusè trigonum, oblongum: *stigmata* replicata, intùs canaliculata. *Caps.* oblato-globosa, obsoletè trilobo lobis obsoletis: *Semina* numerosa, cumulata, foliaceo-compressa, nigra.

Patria incerta. Creditur venire Capite Bonæ Spei.

31. *purpurea.* A. limbo erecto rotato-turbinato, subobliquato, tubo æquante faucem membranâ conferruminato-duplicatam: staminibus erectis, incurvo-patentibus.

Amaryllis purpurea. *Hort. Kew.* 1. 417. *ed.* 2. 2. 242. *Willd. sp. pl.* 2. 53. *Nobis in Curt. magaz.* 1430.

Amaryllis elata. *Jacq. hort. schoenb.* 1. 32. *t.* 62.
Amaryllis speciosa. *L'Heritier sert. angl.* 12.
Crinum speciosum. *Linn. fil. suppl.* 195. *Thunb. prod.* 59.
α. major; coccineo-rubens, fauce hyalinâ; antheris longioribus.
β. minor; cerasino-rubens, fauce opacâ; antheris brevioribus.

Bulbus oblongo-ovatus, fuscus. *Folia* interiora altiora, subæquantia *scapum* compresso-cylindricum 2—3-pedalem. *Spatha* longior *pedunculis* 2—3-plo brevioribus flore. *Corolla* sanguineo-punicea, triuncialis, erecta, infundibuliformis: *tubus* rotundatè trigonus; *faux* latè turbinata, per membranam interstitiis laciniarum obsoletè sexdentatam connato-duplicata; *limbus* obsoletè irregularis, huic subæqualis, *laciniæ* reticulato-rugosulæ, extimæ rhombeo-ovatæ acutulæ, intimæ ovali-lanceolatæ $\frac{1}{3}$ parte angustiores. *Filamenta* inclusa, alternè subbreviora: *antheræ* verticalitèr appensæ, versatiles. *Stylus* inclinatus, incurvus; *stigmata* obsoletè trina. *Germen* oblongum viride. *Semina* paleaceo-complanata, nigra.

Patria: Caput Bonæ Spei.

32. *coranica.* A. numerosiflora; foliis alternè utroque versùs falcato-obliquatis; scapo plano; corollis regularibus, tubo bis breviore limbo revoluto: staminibus erecto-patentibus.

Amaryllis coranica. *Nobis in Botanical Register* 139; *cum ic.*

Bulbus diametro modò 9-unciali, membranis innumeris in crassam corticem conferruminatis involutus. *Folia* lorata, 6—12, sesuncialia ad bipedalia, latiora sesquiunciam transversa, glauca, serrulato-ciliata. *Scapus* planus, anceps, glaucus, inclinatus, duplo longior umbellâ. *Flores* 20—40, convexiùs umbellati, successivis vesperis expandentes, odorati, purpureo-pallescentes; *pedicelli* teretes, bis breviores corollâ, neque ac in proximâ Brunsvigiâ *falcatâ* cum fructû clavato-elongandi. *Germen* polyspermum. *Corollæ* tubus subuncialis; limbus eodem duplo longior, turbinato-campanulatus, revolutus, laci-

niis lineari-lanceolatis subæqualibus. *Stamina* ¼ parte breviora limbo: *antheræ* lunulatæ, vibratæ. *Stigma* punctum obtusum.

Patria: Africa Australis, in agro gentis Coranensis.

VI. *Hexapetalo-partitæ: subrotatæ. Folia bifaria.*

33. *aurea.* A. floribus pedicellatis erectiusculis, corollis infundibuliformi-clavatis, laciniis lineari-lanceolatis, genitalibus rectis, foliis linearibus erectis canaliculatis margine reflexo glabro. *Hort. Kew.* 1. 419.

Amaryllis aurea. *L'Heritier sert. angl.* 14. *Curt. magaz.* 409. *Jacq. hort. schoenb.* 1. 38. *t.* 73. *Willd. sp. pl.* 2. 57. *Redouté liliac.* 61. *Hort. Kew. ed.* 2. 2. 227.

Bulbus subrotundus. *Folia* plura, lorata, canaliculata, acuta, infernè involuta, sesquipedalia, vix unciam lata, erecta. *Scapus* subbipedalis, compressiusculus, pollicem crassus. *Spatha* fusca, lanceolata, sphacelata, plurimùm longior pedicellis, 5—10-flora. *Pedicelli* inæquales longiores unciales. *Corolla* lutea, triuncialis ,. magìs, infundibuliformis, anticè subventricosa: *tubus* trigonus, vix semuncialis, virens; *laciniæ* angustæ, lingulato-lanceolatæ, suprà reflexæ et subundulatæ, nervo medio dorsali virentes. *Filamenta* laxiùs fasciculata, subinclinata, alterna subexserta, alterna subinclusa. *Antheræ* lineari-oblongæ, erectæ. *Germen* ovale, obtusè trigonum. *Stylus* curvaturâ leni inclinatus; *stigmata* 3 rubra in unum coarctata. *Decerptìm ex Horto Kewensi et Jacquino.*

Patria: China.

34. *curvifolia.* A. multiflora; foliis angustè loratis subinvolutis glaucis a margine altero subfalcato-curvatis; laciniis lineari-lanceolatis undulatis de medio revoluto-rotatis; staminibus erectis, subexsertis.

Amaryllis curvifolia. *Jacq. hort. schoenb.* 1. 33. *t.* 64. *Willd. sp. pl.* 2. 59. *Redouté liliac.* 274. *Hort. Kew. ed.* 2. 2. 228.

Amaryllis Fothergillia. *Andrews's reposit.* 163.

Amaryllis humilis. *β. nob. in Curt. magaz.* 1089. *Hort. Kew. ed.* 2. 2. 229; *(non quoad varietatem α.)*

Amaryllis corusca. *Nob. in Curt. magaz.* 1430; *in notâ versi folii.*

α. floribus coccineis.

β. floribus miniatis.

Bulbus subrotundus. *Folia* plura, firmula, erecto-patentia, subtus convexula, parùm attenuata, obtusa, pedalia, semunciam lata *v.* latiora. *Scapus* calamo majore crassior, compressiusculus, sesquipedalis ultràve, glaucus. *Flores* suboctoni *v.* plures, inodori sæpiùs plures ac in *sarniensi*, *pedunculis* rectis biuncialibus. *Spatha* lanceolata reflexa. *Corolla* sesquiunciam alta, coccinea *v.* miniata micans, ad medium usque subconnivens, indè revolutìm stellata. *Filamenta* ruberrima fasciculata, alternè breviora: *antheræ* incumbentes. *Germen* intensè viride, turbinato-sphæricum. *Semina* 1-2, bulboso-laxata, viridia, subrotunda.

Patria: Caput Bonæ Spei.

35. *sarniensis*. A. pluriflora; foliis pluribus angustè loratis subinvolutis, non glaucis, rectis.

α. foliis tardioribus scapo aphyllo.

Amaryllis sarniensis. *Linn. sp. pl.* 1. 421. *Thunb. jap.* 131. *L'Heritier sert. angl.* 15. *Hort. Kew.* 1. 420. *ed.* 2. 2. 227. *Willd. sp. pl.* 2. 59, *Curt. magaz.* 298. *Redouté liliac.* 33.

Amaryllis dubia. *Houttuyn nat. hist.* 12. 181. *t.* 82. *fig.* 1.

Narcissus japonicus rutilo flore. *Cornuti canadens.* 157, *t.* 158. *Ehret pict. t.* 9. *fig.* 3.

Lilium sarniense. *Douglas monogr. t.* 1. 2.

β. foliis floribusque isocronis; corolla roseo-rubente. *Nob. Jacq. hort. schoenb.* 1. 34. *t.* 66. *Willd. sp. pl.* 2. 59. *Hort. Kew. ed.* 2. 2. 228.

γ. floribus coccineis foliorum isocronis.

Amaryllis venusta. *Nobis in Curt. magaz.* 1090.

Bulbus ovatus. *Folia* 5 *v.* circà, angustiùs lorata, obtusa, obsoletiùs involuto-concava, sesquipedalia, semunciam

lata. *Scapus* compressus, altitudine foliorum. *Flores* subseni *v.* plures, *pedunculis* sesquiuncialibus. *Corolla* solo disco incrassato connexa, revoluto-rotata, suprà undulata, sesquiunciam profunda, micans. *Filamenta,* disco medio corollæ connato-defixa, subexserta, rubra; *antheræ* violaceæ, vibratæ, polline luteo. *Stylus* ruber. *Stigmata* replicata, vel coadunata.

Patria : α Japonia. β. γ. Caput Bonæ Spei.

36. *radiata.* A. multiflora; laciniis 5 vel omnibus in radium semicircularem assurgentibus, undulatis; staminibus deflexis, duplo longioribus corollâ.

Amaryllis radiata. *L'Heritier sert. angl.* 16. *Hort. Kew.* 1. 421. *ed.* 2. 2. 228. *Willd. sp. pl.* 2. 60. *Andrews's reposit.* 95.

Lilio-Narcissus V. *Seligm. aves. t.* 35.

Yuck-lan. *Chinensibus. Roxb. MSS. ined. cum tab.*

Bulbus rotundus. *Folia* plura, ligulata, obtusula, semunciam *v.* circitèr lata. *Spatha* 2-valvis 4—8-flora. *Scapus* teres, 1—2-pedalis, calamum crassus. *Umbella* brevè pedicellata, divaricata, coccinea, magnitudine ferè *sarniensis. Corolla* æqualis, subunilabiato-rotata, laciniis lineari-oblongis, ex utrinque summam mediam versùs obliquatis vel nunc infimâ sub stylo per se stante, acuminatis, revolutis, basi glandulosâ invicèm connexis, uncialibus vel magìs. *Antheræ* parvæ, incumbentes. *Stigma* parvum.

Patria: China: Japonia, affirmante specimine nativo in Herbario Dom. A. B. Lambert videndo.

37. *undulata.* A. laxiùs multiflora; foliis paucis, lorato-linearibus; corollâ recurvo-stellatâ, irregulari, laciniis obversèlinearibus canaliculatis, crispis, imâ staminibus deflexis subtensâ.

Amaryllis undulata. *Syst. Veg. ed.* 13. 264. *L'Heritier sert. angl.* 16. *Hort. Kew.* 1. 420. *ed.* 2. 2. 228. *Jacq. hort. vindob. Curt. magaz.* 369. *Willd. sp. pl.* 2. 60. *Meerburgh ic.* 1. *t.* 13. *J. Fr. Miller ic.* 8. *Redouté liliac.* 115.

Bulbus ovo columbino minor, indusiis fibroso-membranosis, albicantibus. *Folia* 2 lineas circitèr lata, involuto-canaliculata. *Flores* 12 v. plures, *pedunculis* subflexilibus breviores, inodori. *Corolla* roseo-rubescens, laciniis mucronatis divaricatis, imâ subrèmotiore. *Filamenta* fasciculata, rosea, inæqualia, longiora ex unâ quartâ parte breviora corollâ. *Scapus* modò sesquipede longior, parùm crassior pennâ corvinâ. *Germen* oblato-globosum, torosum. *Semina* bulboso-laxata, viridia, è capsulâ tenui præcociùs prorumpentia

Patria: Caput Bonæ Spei.

38. *humilis.* A. multiflora; foliis paucis ligulatis canaliculatis limbi laciniis sursùm unilabiato-obliquatis: staminibus declinatis brevioribus corollâ.

Amaryllis humilis. *Jacq. hort. schoenb.* 1. 36. *t.* 69. *Willd. sp. pl.* 60. *Nobis in Curt. magaz.* 726. *Redouté liliac.* 449.

Bulbus indusiis fibroso-membranaceis, plexû intergerino fibrarum bombycino atque ductili. *Folia* obtusa, vix tertiam partem unciæ lata. *Scapus* modò bipedalis teres, virens, non duplo pennâ corvinâ crassior. *Flores* inodori, duplo majores A. *undulatæ*, pedicellis divaricatis filiformibus longioribus spathâ. *Corolla* divaricata, rosea, recurvo-stellata, irregularis laciniis ligulatis deorsùm attenuatis undulatis acutis, infrà divaricatis, utrinque summam mediam versùs assurgentibus, margine reflexo. *Germen* virens, oblato-sphæroideum, subtrilobo-torosum. *Filamenta* fasciculata, rubra; *antheræ* violaceæ, vibratæ. *Stigmata* replicata. *Capsulæ* loculi 2—4-spermi: *semina* bulboso-laxata, virentia.

Patria: Caput Bonæ Spei.

39. *flexuosa.* A. pauciflora; foliis loratis angustis obtusulis minutè pustuloso-punctatis; limbi laciniis recurvo-divaricatis undulatis, unâ fasciculo declinato staminum subtensâ, remotâ.

Amaryllis flexuosa. *Jacq. hort. schoenb.* 1. 35. *t.* 67. *Willd.*

sp. pl. 2. 60. *Hort. Kew. ed.* 2. 2. 229. *Nobis in Botanical Register.* 2. 172; *cum ic.*

Undulata minor multiflora; *humilis* major pluriflora; *flexuosa* maxima pauciflora; cæterum inter se persimiles. Hujus *folia* modò pedalia, semunciam lata, subtùs pallentia et conspicuiùs pustulata. *Scapus* bipedalis modò calamum crassus. *Umbella* laxa, *pedunculis* strictis fragilibus, longioribus *spathâ* subroseâ lanceolatâ sphacelatâ. *Corolla* rosea, laciniis tantùm ex disco incrassato connexis, cæterum distantibus. *Stigmata* 3, replicata, rubra, puberula. *Germen* loculis suboctospermis. *Capsula* bulbisperma.

Patria: Caput Bonæ Spei.

VII. *Bulbispermæ constanter? Vix? Folia multifaria.*

40. *longifolia.* A. umbella suberecto-multiflora, brevè et obesè pedicellata; foliis lorato attenuatis glaucis; tubo subduplo longiore limbo.

Amaryllis longifolia. *L'Heritier sert. angl.* 13. *Hort. Kew.* 1. 419. *ed.* 2. 2. 227. *Jacq. ic. rar.* 2. 364. *Ejusd. fragm.* 3. *t.* 2. *f.* 1; *quoad fructum. Willd. sp. pl.* 2. 56. *Nobis in Curt. magaz.* 661. *Redouté liliac.* 347; (*undique excluso Linnæo cum synonymis suis* BRUNSVIGIAM falcatam *intelligentibus*).

Amaryllis bulbisperma. *Burm. prod.* 9.

Amaryllis capensis. *Mill. dict. ed.* 8. *n.* 12.

Folia multifariàm recurvanda, basi invicèm involuto-complexa, scapo longiora, interiora canaliculata. *Scapus* sesqui-bipedalis, subcylindricus, solidus. *Flores* 6-8, sesunciales *v.* ultrà, roseo-rubentes, indê exalbescentes, odori. *Germen* ellipticum, 3-sulcum, toroso-trilobum, virens. *Corollæ tubus* trisulcus, rotundatè trigonus, pedunculum referens, nunc curvulus; *limbus* subsemiringens, duplo brevior *tubo*, turbinato-campanulatus, laciniis ovali-oblongis, obtusis. *Stamina* inclinata, subæqulia, parùm breviora limbo: *antheræ* vibratæ, vacuæ lunatæ. *Stigma* depresso-subcapitatum. *Capsula* bulbisperma.

Patria: Caput Bonæ Spei.

41. *revoluta.* A. pluri-multiflora; foliis lorato-acuminatis glauciusculis, floribus erecto-recurvulis, pedicellatis, cucullatis; limbo patulo revoluto obsoletè irregulari, duplo longiore tubo.

Amaryllis revoluta. *L'Heritier sert. angl.* 4. *Hort. Kew.* 1. 419. *ed.* 2. 2. 227. *Willd. sp. pl.* 2. 57. *Nob. in Curt. Magaz.* 915. *cum tab.* 917; *in notâ.* 1178, *cum tab. exemplario vegetiore desumptâ.*

Amaryllis variabilis. *Jacq. hort. schoenb.* 4. *t.* 428.

Folia ad 12 usque, in orbem recurvanda, interiora gradatìm angustiora acutiùs canaliculata, exteriora involuta, modò bipedalia, 2 uncias lata. *Scapo* his altior, compresso-cylindricus. *Spatha* longior *pedicellis. Flores* suaveolentes triunciales magìsve. *Germen* breve ellipticum, exsulcum læve. *Corolla* tubuloso-infundibuliformis, intùs albida, extùs tubo et secundùm medium laciniarum suffuso roseo et viriditate varia: *tubus* linearis rotundato-angulosus, virescens, flexus; *faux* cucullata profunda, *laminæ laciniarum* revoluto-patulæ, intimæ sublatiores. *Filamenta* declinata, parùm inæqualia. *Stylus* corollæ subæqualis; *stigmate* parvulo, orbiculato aperto. *Semina* solitaria in loculis, cavitati conformia.

Patria: Caput Bonæ Spei.

42. *zeylanica.* A. (sessiliflora) foliis plurimis lorato-lanceolatis undulatis, medio crassis, margine lævi; corollis obsoletè bilabiatis, limbo tubo; subæquali cernuo.

Amaryllis zeylanica. *Linn. sp. pl. ed.* 2. 1. 421. *L'Heritier sert. angl.* 13. *Willd. sp. pl.* 2. 56.

Amaryllis ornata. *nob. in Curt. Mag.* 1171. *Hort. Kew. ed.* 2. 2. 226.

Crinum latifolium. *Andrews's reposit.* 390.

Crinum zeylanicum. *Linn. sp. pl. ed. Reich.* 2. 24.

L. N. zeylanicus. *Comm. hort. amst.* 1. 73. *t.* 73. *Rudb. elys.* 2. 191. *f.* 2.

Tulipa Javana. *Rumph. amb.* 5. 306. *t.* 105.

Folia exteriora in orbem recumbentia, sedecim usque

ultra, modò tripedalia, latitudine triuncialia, concaviuscula, striata. *Scapus* modò 3-pedalis, purpurascens. *Umbella* pluri-multiflora. *Flores* magni, purpureo-albicantes, odoratissimi. *Tubus* subtriuncialis erectus rotundato-trigonus, intensè purpureus, stipitem v. pedunculum crassum referens: limbus vix brevior, subbilabiato-campanulatus, reflexus, laciniis oblongo-lanceolatis, recurvis apice, summâ mediâ porrecto-depressâ. *Stamina* declinata, tertiâ ferè parte breviora limbo. *Stigmata* 3 brevia, in *stylo* gracillimo. *Semina* bulboso-laxata, sæpiùs unicum.
Patria: India Orientalis. Ceylon.

43. *ornata.* A. (sessiliflora) foliis plurimis lorato-attenuatis, canaliculatis, margine scabro; limbo obsoletè bilabiato, breviore tubo subnutante.

Amaryllis ornata. *Hort. Kew.* 1. 418. *Willd. sp. pl.* 2. 55. (α) *Nobis in Curt. Mag.* 1253. (β) *Hort. Kew. ed.* 2. 2. 226.

A. Broussonetii. *Redouté liliac.* 62.

A. spectabilis. *Andrews's reposit.* 390.

A. yuccæides. *Thompson's bot. displ. t.* 12.

Crinum yuccæflorum. *Salisbury paradis.* 52.

Lilio-Narcissus africanus, &c. &c. *Ehret pict. t.* 5. *f.* 2. *Trew Ehret. t.* 13.

α.) uniflora; scapo purpureo; foliis angustis acutè canaliculatis.

β.) pluriflora; scapo virente; foliis non undulatis; limbo corollæ staminibusque erectiusculis.

γ.) pluri-multiflora; scapo viridi; foliis undulatis; limbo nutante.

Hanc olim cum Dryandro habuimus pro varietate antecedentis. At certè distincta. Ipsa forsan dividenda?

Patria: Guinea, Sierra Leone, Capo Corso (Anglis depravatè Cape-Coast.) β. Senegal.

44. *gigantea.* A. (sessiliflora) foliis plurimis oblongo-lanceolatis, utrinque angustatis, undulatis, sulcato-striatis, margine scabro; limbo nutante, obsoletè bilabiato, breviore tubo.

Amaryllis gigantea. *Hort. Kew. ed.* 2. 2. 226.
Amaryllis ornata. *β. Nobis in Curt. Magaz.* 923.*
Amaryllis Jagus. *Thompson's bot. displ. t.* 6.
Crinum giganteum. *Andrews's reposit.* 169. *Redouté liliac.* 181.

Bulbus ovatus, nunc æquans caput infantis. *Folia* nunc tripedalia, exteriora latiora recumbentia, lato-oblonga. *Scapus* subtripedalis. *Umbella* sub-7-flora diffusa. *Flores* 7—8-unciales *v.* ultrà, albi, odorati. *Corolla* subhypocrateriformi-campanulata, *tubo* virente crassè pedunculoideo, abruptiùs transeunte in *limbum* patentissimum; laciniis unciam latis, elliptico-lanceolatis, summâ antrorsùm depressâ. *Semen* solitarium, maximum, bulboso-laxatum.

Patria: Sierra Leone.

45. *latifolia.* A. spatha multiflora, floribus pedicellatis basi tubulosis, foliis oblongo-lanceolatis. *L'Heritier sert. angl.* 14.

Amaryllis latifolia. *Willd. sp. pl.* 2. 57.
Crinum latifolium. *Linn. sp. pl.* 1. 419.
Sjovanna-pola-tali. *Rheede malab.* 11. 77. *t.* 39. *Rudb. elys.* 2. 91. *fig.* 12.

Folia costâ crassâ, margine scabro. *Scapus* plano-compressus, 3-pedalis. *Flores* 5—6, candidi, subodorati, 4—5-pollicares; laciniis pollicem latis. *Stamina* purpurea: *antheræ* flavæ. *Rheede.*

Patria: India Orientalis.

VIII. *Germen loculamentis dispermis. Folia petiolata.*

46. *hyacinthina.* A. umbella subsessili; foliorum lamina varicoso-nervosa; corollæ laciniis 2 summis lateralibus arrectis collaterali-conniventibus: stamine summo remoto accumbente.

Amaryllis hyacinthina. *Nobis in Botanical Register.* 163; *cum ic.*

Bulbus ovatus. *Folia* 2—3, Hemerocallidis *cæruleæ* subsimilia, bifaria?, inflorescentiâ diù tardiora, ovato-

oblonga acumine abrupto, plana, nervosa atque lineolis transversis cancellata, saturatè viridia costâ mediâ crassâ carinata 8-uncialia, uncias tres lata: *petioli* crassi, plano-convexi, 3-plo breviores. *Scapus* longior foliis, cylindricus. *Spatha* multò brevior floribus. *Flores* 9—10, erecto-nutantes, uncias 2 cum dimidio longi, albo et hyacinthino varii, inodori. *Corolla* infundibuliformis, ringens, inæqualis; *tubus* violaceo-pallidus, pluriès brevior limbo, antrorsùm flexus, cylindricus, cum nervo postico subvaricoso: *limbus* de *fauce* brevi nudâ et subtùs gibbosâ semiradiato-dispansus, *laciniæ* lanceolatæ, subundulatæ, exteriores 3 et interiorum ima media angustiores consimiles violaceo-pallentes: *labii summi* tres arrecto-convergentes, harum laterales latiores firmiores planiores intensè hyacinthinæ, disco maculâ albà elongato-oblongâ pictæ; *labii infimi* 3 stellatæ, harum laterales apice revolutæ, media deflexa. *Stamina* $\frac{1}{3}$ parte breviora limbo, declinata, albicantia; summum arrectum reflexum, distans. *Antheræ* breves, oblongæ, pallidæ. *Stigma* punctum simplex. *Germen* subglobosum, subcoloratum, *loculamentis* collaterali-dispermis: *ovula* erecta oblonga, fundo affixa, ferè ac in Pancratio *amboinensi* et nonnullis aliis ejusdem generis.

Patria: Brasilia.

Loci sortiendi reliquis non suprà recensitis speciebus, sub Amaryllide in "*Speciebus Plantarum Willdenovii*" obviis.

No. vol. pag.

8. clavata. *v.* 2. *p.* 52; est Cyrtanthus angustifolius. *nob. in Botanical Register.* t. 2. 168.

12. linearis *v.* 2. *p.* 53. *Ob adumbrationem imperfectam incerta.*

15. tatarica. *v.* 2. *p.* 54. Alstrœmeriæ *species? Vix? Potiùs cum* montanâ, *cujus congener certus, genus condentes novum. Flores non umbellati; capsula elongato-oblonga, nervis* 12 *prominentibus striata. Laciniæ corollæ medio trinerves. Planta caulescens, non scaposa. Specimen vidimus archetypum in Herbario Dom. A. B. Lambert.*

18. falcata. *v.* 2. *p.* 55; *est* Brunsvigia falcata. *nob. in Curt. Magaz.* 1443.

21. montana. *v.* 2. *p.* 56; *congener* tataricæ; *si non altera eadem. Specimen archetypum Labillardieri in Herb. Dom. A. B. Lambert.*

26. orientalis. *v.* 2. *p.* 58; *est* Brunsvigia multiflora. *Hort. Kew. ed.* 2. 2. 230.

28. marginata. *v.* 2. p. 59; *est* Brunsvigia marginata. *nob. in Curt. Magaz.* 1443; *folio altero, verso.*

34. Radula. *v.* 2. *p.* 61; *est* Brunsvigia Radula. *nob. loc. cit.*

35. striata. *v.* 2. *p.* 61; *est* Brunsvigia striata. *nob. loc. cit.*

36. crispa. v. 2. *p.* 61; *est* Strumaria crispa. *nob. loc. cit.* 1363.

37. stellaris. *v.* 2. *p.* 61; *est* Strumaria stellaris. *nob. loc. cit.*

38. caspia. *v.* 2. *p.* 62; *est* Allii *species*; *affirmante archetypo Pallasiano in Herb. Dom. A. B. Lambert.*

Affinitates generis.

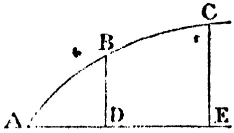
Accedit Narcisso, ex *luteâ;* Strumariæ, ex *chloroleucâ;* Pancratio, ex *purpureâ*, et ad alia diversa puncta, ex speciebus cum tubo coronato; Cyrtanthio, ex *vittatâ;* Brunsvigiæ, hinc ex *coranicâ*, indè ex *flexuosâ;* Crino, ex speciebus bulbispermis foliis multifariis.

Art. XIV. *Solutions of some Problems by Means of the Calculus of Functions. By* Charles Babbage, *Esq. F.R.S.*

PROB. I.

Required the nature of a curve ABC such that if any two abscissæ AD and AE be taken whose rectangle is equal to a

given square, then the rectangle of their corresponding ordinates BD and CE shall be equal to another given square



let AD $= x$ and BD $= y = \psi x$, and let the two given squares be a^2 and c^2 then by the problem

$$\text{AD} \times \text{AE} = a^2 \text{ and BD} \times \text{CE} = c^2$$

hence $\text{AE} = \frac{a^2}{\text{AD}} = \frac{a^2}{x}$ and $\text{CE} = \psi\,(\text{AE}) = \psi\left(\frac{a^2}{x}\right)$

and the functional equation which results is

$$\psi x \times \psi\left(\frac{a^2}{x}\right) = c^2$$

As this equation is not generally soluble by the direct method which I have proposed, we must endeavour to find some particular solution which may contain an arbitrary constant. If a^2 were equal to c^2 it is evident that the equation would be satisfied by supposing $\psi x = x$ or $\psi x = x^n$. Let us therefore assume $\psi x = \text{A}x^n$

then $$\psi\left(\frac{a^2}{x}\right) = \text{A}\left(\frac{a^2}{x}\right)^n$$

and the equation becomes

$$\text{A}^2 x^n \left(\frac{a^2}{x}\right)^n = \text{A}^2 a^{2n} = c^2$$

hence $$\text{A} = ca^{-n}$$

and the solution of the given equation is

$$\psi x = c\left(\frac{x}{a}\right)^n$$

This solution contains the arbitrary constant n which may, as I have shown in* Prob. VIII. be changed into any arbitrary function of x which does not vary when x becomes $\frac{a^2}{x}$; such a function is $\chi\left(\overline{x}, \overline{\frac{a^2}{x}}\right)$ which denotes any symme-

* See an Essay towards the Calculus of Functions in the last Volume of the Philosophical Transactions.

trical function of x, and $\frac{a^2}{x}$ consequently the general solution of the given equation is

$$\psi x = c\left\{\frac{x}{a}\right\}^{\overline{\chi}\left(x, \frac{\overline{a^2}}{x}\right)}$$

hence the equation which comprehends the species of curves which is required, is

$$y = c\left\{\frac{x}{a}\right\}^{\overline{\chi}\left(x, \frac{\overline{a^2}}{x}\right)}$$

when the arbitrary function is equal to a constant quantity, we have the particular solutions already noticed

$$y = c\left(\frac{x}{a}\right)^n$$

and since n may whole or fractional, positive or negative, it follows that all parabolas and hyperbolas of every degree, possess the required property.

The equation $\psi x \,.\, \psi\left(\frac{a^2}{x}\right) = c^2$ may otherwise be solved in the following manner; assume $\psi x = \mathrm{AB}^{\varphi x}$, then the equation becomes

$$\mathrm{A}b^{\varphi x} \times \mathrm{A}b^{\varphi\left(\frac{a^2}{x}\right)} = c^2$$

which will be satisfied if $\mathrm{A} = a$ and $\varphi x = -\varphi\left(\frac{a^2}{x}\right)$ we must therefore endeavour to discover a particular solution of $\varphi x = -\varphi\left(\frac{a^2}{x}\right)$, the first which presents itself is $\varphi x = x - \frac{a^2}{x}$ this being substituted gives

$$\psi x = cb^{x - \frac{a^2}{x}}$$

and since b is arbitrary it may be changed into any arbitrary function which does not vary when x is changed into $\frac{a^2}{x}$, hence the general solution is

$$\psi x = c\left\{\overline{\chi}\left(x, \frac{\overline{a^2}}{x}\right)\right\}^{x - \frac{a^2}{x}}$$

This solution suggests a similar one of the more general problem when AE is equal to any given function α of AD, provided $\alpha^2 x = x$, in this case we have AD $= x$ AE $= \alpha x$ and the equation to be satisfied is

$$\psi x \, , \psi\alpha x \, . \, x = c^2$$

put $\psi x = cb^{\phi x}$ then it becomes

$$cb^{\phi x} \times cb^{\phi\alpha x} = c^2$$

which will be fulfilled if $\phi x = -\phi\alpha x$,
a particular solution of this equation is $\phi x = x - \alpha x$,
for then $\phi\alpha x = \alpha x - \alpha^2 x = \alpha x - x$
hence the general solution of $\psi x \, . \, \psi\alpha x = c^2$ when $\alpha^2 x = x$ is

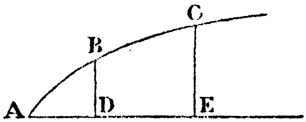
$$\psi x = c\left\{\chi(\overline{x}, \overline{\alpha x})\right\}^{x - \alpha x}$$

A similar solution is also applicable to the same equation when $\alpha^{2n} x = x$ in that case it is

$$\psi x = c\left\{\chi(\overline{x}, \overline{\alpha x}, \overline{\alpha^2 x}, \ldots \overline{\alpha x^{2n-1}})\right\}^{x - \alpha x + \&c. - \alpha^{2n-1} x}$$

PROB. II.

Required the nature of a curve ABC such that supposing AD any abscissa, if we take another abscissa AE having any given relation to the former, then the ordinate CE corresponding to the second abscissa shall have the same given relation to the ordinate BD corresponding to the first abscissa



Let the first abscissa AD be denoted by x, and let the relation of the second abscissa AE $= x'$ to it be expressed by αx, α being some given function, then if BD $= y = \psi x$ we have CE $= y' = \psi\alpha x$, and by the conditions of the Problem

$$\alpha\psi x = \psi\alpha x$$

this equation will evidently be satisfied if $\psi = \alpha$ or more generally if $\psi = \alpha^n$, for it then becomes

$$\alpha\alpha^n x = \alpha^n \alpha x$$

which is identical.

If it should happen that for some particular value of n we find $\alpha^n x = x$, then the solution $\psi x = \alpha^n x$ admits of only $p - 1$ values, p being the least value of n which satisfies the equation $\alpha^p x = x$.

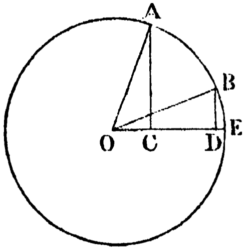
Suppose it were required that the sum of the squares of the two abscissæ should be equal to a constant quantity, then the sum of the squares of the corresponding ordinates must be equal to the same quantity, and the equation becomes

$$\psi(\sqrt{a^2 - x^2}) = \sqrt{a^2 - (\psi x)^2}$$

and the solution corresponding to $\psi x = \alpha x$ is

$$y = \psi x = \sqrt{a^2 - x^2}$$

which is the equation to a circle, the abscissæ beginning at the centre and having for its radius the quantity a



In fact, if in any circle OABE we take any two abscissæ OC, and OD so related that the sum of their squares shall be equal to the square of the radius OA; it is easy to show that the two triangles OAC and OBD are similar and equal, and consequently that the sum of the squares of the two ordinates AC and BD is also equal to the square of the radius: in the case just examined, we find $\alpha^2 x\, c = x$, consequently we cannot from this method deduce any other solution.

The solution of the equation $\psi \alpha x = \alpha \psi x$ may be rendered more general, when $\alpha^n x = x$ by the following means, since it is satisfied by supposing $\psi x = \alpha^p x$ whatever may be the value of p, for p substitute any symmetrical function of $x, \alpha x, \ldots \alpha^{n-1} x$, and the general solution is

$$\psi x = \alpha^{\chi(\overline{x}, \overline{\alpha x} \ldots \overline{\alpha^{n-1} x})} x$$

PROB. III.

What is the relation between x and y such that if

$$x = a + by + cy^2, + \&c.$$

we may by reverting the series have*

$$y = a + bx + cx^2 + , \&c.$$

Let $x = \psi y$ then by the condition of the Problem we have also $y = \psi x$, hence $x = \psi y = \psi\psi x = \psi^2 x$, and the nature of the function ψ is determined from the equation

$$\psi^2 x = x$$

the solution of this equation is already known,* and any of the various values of ψx will when expanded, produce a series of the required form, such for example are

$$x = \psi y = \sqrt{1 - y^2} \text{ or } x = \frac{a - by}{b + cy}$$

In fact, if from any symmetrical function of x and y we find the value of x expressed in terms of y, it is clear that y might be expressed in terms of x in precisely a similar manner, and this is nothing else than a different mode of denoting the general solution of the equation $\psi^2 x = x$.

PROB. IV.

What operation must be performed on x so that if we repeat the same operation on the result, and on this result again repeat the same operation, and so on, after performing it four times, the last result may be equal to the original quantity.

Let the operation to be performed be denoted by the characteristic ψ, then the first result is ψx, and repeating the same operation four times, we have

$$\psi\psi\psi\psi\, x = \psi^4 x$$

and by the condition of the Problem this must be equal to the original quantity; hence

$$\psi^4 x = x$$

In order to solve this equation, let us suppose $\psi x = \overset{-1}{\phi} f\phi x$, $\overset{-1}{\phi}$ signifying the inverse operation of ϕ then $\psi\psi x =$

* See Prob. IX. of an Essay towards the Calculus of Functions in the Philosophical Transactions for the year 1815.

$\overset{-1}{\varphi} f\varphi\overset{-1}{\varphi} f\varphi x = \overset{-1}{\varphi} f^2 \varphi x$ and we shall find $\psi^3 x = \overset{-1}{\varphi} f\varphi\overset{-1}{\varphi} f^2 \varphi x = \overset{-1}{\varphi} f^3 \varphi x$ and $\psi^4 x = \overset{-1}{\varphi} f\varphi\overset{-1}{\varphi} f^3\varphi x = \overset{-1}{\varphi} f^4 \varphi x$ from which substitution the equation becomes

$$\overset{-1}{\varphi} f^4 \varphi x = x,$$

and performing the operation indicated by ψ on both sides we have

$$f^4 \varphi x = \varphi x$$

this equation will be identical if we assume such a value for f, that $f^4 y = y$, that is, we must make f a particular solution of the given equation.

A particular solution of the more general equation may be found from the following curious property of the function $\frac{a + bx}{c + dx}$, if this function be called fx, then will its n^{th} function or $f^n x$ always be of the same form, or $f^n x = \frac{A + Bx}{C + Dx}$ when A, B, C, and D, are given functions of a, b, c, and d: and these latter quantities may always be so assumed that $A = o$, $B = C$ and $D = o$.

By employing this property, we have in the present instance as a particular solution of $f^4 x = x$,

$$fx = \frac{a + bx}{c - \frac{b^2 + c^2}{2a} x}$$

and by substituting this value of f we have for the general solution of the equation $\psi^4 x = x$

$$\psi x = \overset{-1}{\varphi} \left\{ \frac{a + b\varphi x}{c - \frac{b^2 + c^2}{2a} \varphi x} \right\}$$

This solution contains an arbitrary function φ, and by assigning various values to it we shall have an indefinite number of particular solutions; a few examples, however, will be sufficient.

Ex. 1. Let $\varphi x = x$ and $a = b = c$, then one particular solution is

$$\psi x = \frac{1 + x}{1 - x}$$

this gives $\psi^2 x = -\frac{1}{x}$ and $\psi^3 x = -\frac{1 - x}{1 + x}$ and $\psi^4 x = x$.

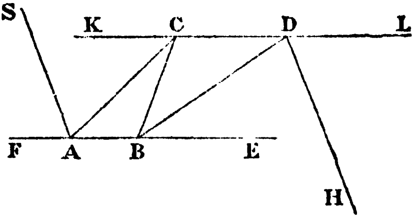
Ex. 2. Let $a = -1$, $b = 1$, and $c = o$, also $\phi x = x$ then $\psi x = 2\frac{x-1}{x}$ which is another solution, for $\psi^2 x = \frac{x-2}{x-1}$, $\psi^3 x = -\frac{2}{x-2}$ and $\psi^4 x = x$.

Ex. 3. a, b, and c remaining the same, let $\phi x = \epsilon^x$, then $\phi^{-1} x = \log x$, and another solution is

$$\psi x = \log(\epsilon^x - 1) - x + \log 2$$

PROB. V.

A ray of light SA falls on a surface AB which reflects it, but not according to the common law of reflexion,



it then impinges on the surface CD which is similarly constituted and parallel to the former; after this it undergoes a second reflexion at the first surface, and also a second reflexion at the other surface.

Now it is found that whatever may be the angle n at which it meets the first plain, that it is always after undergoing the four reflexions parallel to its first direction.

Let the angle SAF which the ray makes with the first surface be θ. and let the angle which the ray makes with that surface, after the first reflexion be denoted by $\psi\theta$: since the two surfaces are parallel, the angle KCA is equal to the angle CAB $= \psi\theta$; and since the surface KL reflects according to the same law as the surface FE, the angle LCB will have the same relation to the angle KCA as the angle CAE has to SAF, therefore LCB $= \psi(\text{KCA}) = \psi\psi\theta = \psi^2\theta$: and in a similar manner it may be shown that DBE $= \psi^3\theta$ and LDH $= \psi^4\theta$, and since by the conditions of the Problem the ray after the last reflexion is parallel to ray before its first incidence we must have

$$\text{LDH} = \text{SAF}$$

which gives

$$\psi^4 \theta = \theta$$

this equation is the same as that of Prob. 5, and one very general solution is

$$\psi\theta = \overset{-1}{\varphi}\left(\frac{a + b\varphi\theta}{c - \frac{b^2 + c^2}{2a}\varphi\theta}\right)$$

φ is arbitrary, and this formula contains an infinite variety of relations between the angle of incidence and that of reflexion, any of which taking place will cause the last ray to be parallel to the first.

It seems probable that this solution, although a very extensive one, does not contain all the possible answers, and if we have regard to the utmost generality, the solution must be deduced from that of the equation

$$F\left\{\overline{\theta, \psi\theta, \psi^2\theta, \psi^3\theta}\right\} = o$$

If we suppose the ray to be parallel to itself after two reflexions the equation will be

$$\psi^2\theta = \theta$$

and all the possible solutions of this equation are I believe contained in the value of $\psi\theta$ deduced from the equation

$$F\left\{\overline{\theta, \psi\theta}\right\} = o$$

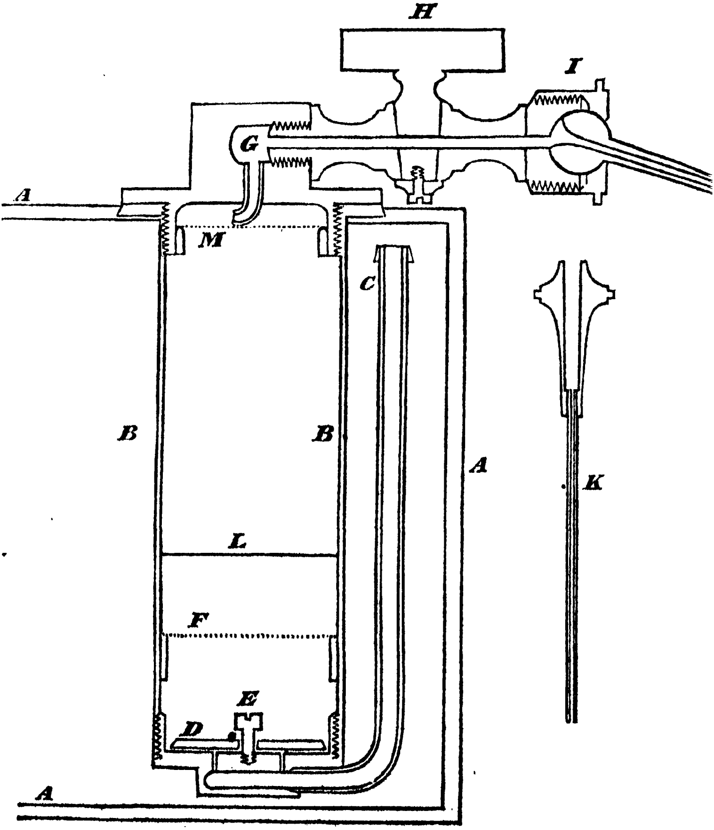
F denoting any symmetrical function whatever.

Art. XV. *An Account of an improved Blow-pipe. In a Letter from Mr.* John Newman, *to the Editor.*

SIR,

In a former Number of your Journal, you inserted for me, an Account of a Blow-pipe, then new to the public. The instrument has since been very generally used, to obtain a high temperature, by the combustion of a mixture of oxygen and hydrogen gases. The mode of rendering this use of the instrument safe, was, by rejecting all jets but such as were of a very fine bore; and, as Sir H. Davy has shewn, that any inflammation of gases may be arrested in its passage, by an aperture sufficiently minute, all danger of the recession of the flame was thus obviated.

A desire, however, to increase the heat, has occasionally led to the use of tubes, through which the flame could pass, and an explosion has consequently happened in the apparatus, to the destruction of the instrument, and the danger of the experimentalist. In order to provide against the recurrence of such events, I have had recourse to a plan suggested by Professor Cumming, of Cambridge, and which I find to be an effectual security against any accidental explosion of the instrument; and I take the liberty of transmitting an account of it to you, that it may be made public in your Journal.



The wood cut annexed, represents a section of the apparatus, and part of the copper box. AAA, is the box for the gases. BB, a piece of brass tube, closed at the bottom, which may be

called the *trough*, is fixed, air tight, into the box. At the upper surface, C is a small tube in the interior, which, commencing near the top, descends to, and is inserted into the bottom of the trough; two or four holes are made from the trough into this tube, and open a communication to the gases in the box; a circular flat valve D, lined with oiled silk or leather, and moveable on a central pin E, covers these holes, and prevents the passage of any thing from the trough into the box. At F, the trough is intersected by a fine wire gauze. The cap of the trough, which screws on air tight, contains a small chamber G, communicating, by a fine tube, with the interior of the trough; and just below the orifice of this tube, is a second piece of very fine wire gauze. The stop-cock B connects the cap with a jet pierced, having a circular motion I; and to this various tubes, as K, may be fitted. A piece of fine wire gauze covers the end of the tube at C, to stop the passage of any thing from the box which may prevent the action of the valve. When the instrument is to be used, the common air should be exhausted from the reservoir, by means of the syringe, and filled with the gases; after which water should be poured into the trough to about L; the gases may then be condensed into the box as formerly, and by their own elastic force, will pass through the tube, the water, and the various screens of wire gauze, and issue out at the jet; but when the inflammation, by the use of a very large jet, or of a slow current through a small one, passes backwards, it is generally arrested by the screen at M; and when it does pass it, it merely explodes the small portion of gas in the upper part of the trough, and does no harm; and the valve D prevents the water from being propelled into the box. In my first essays with the pneumatic trough, I had provided no valve, but then found, that repeated detonations in the trough, gradually forced the water backwards into the box; at present, however, such a circumstance is impossible, unless the valve be out of order, and its simplicity will, I conceive, sufficiently secure its perfect and constant action.

I have frequently tested these blow-pipes, by turning the stream full on, and inflaming it immediately at the stop-cock.

The heat is at first intense; but as the force of the current diminishes, it becomes unable to oppose the progress of the inflammation to the interior of the trough; the gases, therefore, inflame there with a faint sound, and the combustion is extinguished. When the cock is partly turned on, and a lamp is placed before the jet, the whole of the gas may be exploded in the trough by a series of slight detonations, and they are rendered evident by the successive impulses on the flame of the lamp, but produce no further effect.

Whilst the blow-pipe is in the state described, I believe it to be perfectly safe, for I can imagine no possibility of the flame passing into the interior of the box. Experience alone, however, can prove its safety; and as it is possible that some unknown circumstance, or combination of circumstances, may occur, which are not here provided for, I will observe, that I have always made the end farthest from the jet the weakest, and have the satisfaction of knowing, that when the instruments have been burst, (before this preventative was applied,) they have never yielded but at that part; and though at present there may appear no necessity for the same precaution, yet it is my intention constantly to construct them in a similar manner.

I am, Sir,
Your most obedient servant,
JOHN NEWMAN.

Philosophical Instrument maker,
No. 7, Lisle Street, Leicester Square.

ART. XVI. VOYAGE *de Découvertes* AUX TERRES AUSTRALES, *exécuté sur les Corvettes le Géographe, le Naturaliste, et la Goëlette le Casuarina. Rédigé en partie, par feu* F. PERON, *et continué par* M. L. FREYCINET. *Historique, T.* 2. Paris, 1816.

THE second volume of this work has at length appeared. Though it contains some curious and entertaining matter,

it is apparent that more than a fair proportion of the most interesting details and observations was appropriated to the first.

We were, of course, anxious, considering all that has passed, to see what was said, by way of answer, to the charges brought by Captain Flinders against M. Péron. He did not, as we have before observed, live to see the publication of this volume. On his death, he bequeathed his papers to his friend Lesueur: and M. Freycinet was at length appointed by the government to continue the second volume. The author, however, lived to correct the press of the present volume up to p. 231.

M. Freycinet pledged himself to answer the complaints of Captain Flinders, of having been deprived of the merit of a discovery of part of the south-west coast of New Holland. This pledge in the Preface prefixed to the present volume, M. Freycinet has proceeded to redeem. We may be prejudiced, or may have hastily examined the statements, but we cannot consider it in some parts so satisfactory, as M. Freycinet supposes it will be considered; though, inasmuch as it abandons all title to priority in material discoveries originally claimed by the French, it is, of course conclusive. We shall, as nearly as we can, in his own words, give the heads of his arguments.—

"M. Baudin, it seems, was the only person with whom Captain Flinders had any direct communication, and this was merely oral—and the result of this conference, therefore, may have been communicated by M. Baudin to his officers, *with more or less accuracy*.—With respect to Kangaroo Island of Flinders, which, he complains, was changed into Isle Decrés, at Paris, notwithstanding his name was adopted by us during our voyage—it must be observed, though Flinders's sailors might call it Kangaroo Island, because they, like ourselves, found many of these animals there, Péron was well aware that many names given during the course of a voyage, are not always definitively fixed; and it was not till the publication of Flinders's voyage, whereby it would appear what were the exact names fixed, that any thing could be precisely known.—With regard to Spencer and St. Vincent Gulphs, (called by us, Bonaparte and Josephine), their names *could not be known to us*, more especially, as, during Flinders's voyage, they were called by himself *Great and Little Inlet*—a circumstance corroborative of what has been observed

with respect to Kangaroo Island.—Nor, I contend, is the giving names to newly-discovered lands, undescribed in any work, as indicative of an *assumption of the merit of a first discovery*, as insinuated by Captain Flinders, unless ascertained by other circumstances; it cannot be considered more than an avowal of the ignorance of the names imposed by preceding navigators.—Péron certainly was wrong in affirming any thing of Captain Flinders of which he was not certain, and which he, probably, only collected by hearsay, from the boat's crew of Flinders, or rather what the French officers collected, as he did not then speak English—but, although he may have made some mistakes in the statements as to Captain Flinders's route, still, I maintain that, in the whole, he has said enough to shew that Flinders *preceded* us, in part of the coast which we were exploring in concert, for the indication of the *point when the two expeditions met, is alone sufficient to do this*; and his only fault appears to have hazarded details, the truth of which he could not be certain.—Besides, I am persuaded that Péron wrote only that which he conceived was the truth; and I can assert, that I always heard him speak on this subject in the same manner as he had written.—But, however, the question is *now set at rest*, by the publication of the two works, which afford, at once, incontrovertible evidence of what was done by each.—Even admitting all that Flinders said to our commander had been accurately represented to Péron, I ask, how could he point out the different places visited by the Investigator, without either charts or writings relating to them?—Besides, I maintain, after all, that Péron has written nothing in opposition to the *priority of Flinders's discoveries*. *Le Géographe* encountered the *Investigator* at a particular point. They were both charged with discoveries in the south-west of New Holland. Le Géographe went from east to west, the Investigator from west to east.—Péron has in effect stated this, and the conclusion is obvious; that portion of unknown coast *west* of the point of meeting, and which was seen by Flinders, belonged to him, as *first discoverer*; that to the *east* of the same point to Baudin.—As to the details, each navigator is entitled to lay them before the public.—With respect to the term "priority of discovery," it leads to the question, How far it is at all applicable to the reconnoitering shores, of the existence of which there was no question; at least in the present case, there could be no *merit* in priority.—Two navigators, at the same time, or nearly so, ignorant of each others proceedings, reconnoitre a coast from one part to the other—the *discovery*, as far as it may be so called, may be considered as being made at the same time—the difficulties and the dangers are

equal, and the true merit consists in the greater or less accuracy and skill exhibited in the survey of the coast. With regard to *chronological* order, there must, of course, be a *priority of discovery*, and this belongs to such as first saw such and such distinct parts of the coast visited—but the first seeing one particular part cannot be considered as giving a priority to the whole.—In the present instance *discovery* was not the object.—The other shores of New Holland were always known: there could be no question of the *existence* of the south-west part.—The object was solely geographical detail.—

I, therefore, come to the following conclusions, as to the priority of discovery of the different parts of the S.W. coast of New Holland, and which I can venture to say, are the same as M. Péron would have agreed to, had he lived, as indeed would every man desirous of doing justice.

1. Flinders *first discovered* the S. W. coast of New Holland, extending from the eastern extremity of Nuyt's Lands, to longitude 138° 58′ E. of Greenwich.

2. M. Baudin *first discovered* the part of the same coast comprised within the before mentioned longitude 138° 58′, and the longitude 140° 15′ E. G.—that is, from Cape *Monge* to Cape *Buffon* of Flinders, inclusive.

3. Captain Grant *first discovered* that part of the same coast extending from Cape Lannes to Port Western.

4. Captain Flinders's voyage from Nuyt's Land to Cape Lannes, being without knowledge of Captain Baudin's operations, is to be considered as *a voyage of discovery.*

5. The voyage of Captain Baudin, from Port Western to Nuyt's Land, being without knowledge of the discoveries of Flinders or Grant, is to *be considered the same.*

6, 7, and 8. The names given by Flinders to the places which he *first* discovered, are to be preferred, except where Baudin, on the same shore, has named places not visited by Flinders. The same rules to apply to the discoveries of Baudin and Grant.

We shall make no remarks on the foregoing observations, but leave the matter at rest.

Besides the details of the voyage, from the 18th November 1802, to the return to Europe 16th August 1804, this volume contains the author's papers on the English South Sea Fisheries; on some phenomena of the zoology of the southern regions, as applicable to the physical history of the globe, and of the human species: the memoirs on the dysentery and the use of betel; and on the habitation of marine animals, by

Péron and Lesueur: a notice on the vegetable productions of New Holland, by M. Leschenault: and a fragment of a memoir on the preservation of zoological specimens by Péron and Lesueur. Most of these have been before published separately. The memoir on the zoological phenomena, we conceive the most interesting, and we shall, at a future period, give the author's general results. For the present, we shall close this notice with an extract relating to zoological geography—a subject to which M. Péron appears to have given considerable attention.—

In the infancy of the study of natural history, and before the adoption of a technical terminology, voyagers and naturalists perpetually confounded, under the same appellation, animals essentially distinct; and there was no class in the animal kingdom which did not include several species, considered as *orbicolar*, that is, indiscriminately inhabiting all parts of the Globe. Other species, though confined to certain latitudes, were considered as common to all the climates and seas comprised in such latitudes, their existence being held to be independent of the longitudes.—Thus, with respect to the classes of marine animals, we perpetually see it stated, in the works of the most esteemed authors, that the larger whale, (Balæna Mysticetus,) is alike an inhabitant of the seas of Spitzbergen and the South Pole. The sea wolf, sea calf, and sea lions, &c. are made equally to inhabit the most distant seas of the two hemispheres. Reason and analogy alone would render these facts doubtful; experience shews them to be false. Examine the proofs of these pretended identities, and it will be found, that they exist only in their names, and that there is not a single *well known* animal of the northern, which is not specifically distinct from every other animal, *equally well known*, of the opposite hemisphere. I have minutely examined all the descriptions of different writers on the cetaceous tribe, and the phocæ, (the most difficult, on account of the number of species, and consequent near resemblance,) and even in those species, in which the fact of identification was considered as most certainly established, I have invariably found important distinctions.

No one, hitherto, I will venture to affirm, has collected a greater number of animals of the southern hemisphere, than myself. I observed and described them all on the spot; and have brought to Europe many thousand species. Let these be compared with the animals of our hemisphere, and the problem will be immediately resolved—not only with respect to those animals most complicated

and perfectly formed, but in those which are of the simplest organization, and which, on that account, it should seem, would probably be less varied in the system of nature. The comparison, however, will be maintained, even down to the *sponges*, which are generally admitted as the last step in the animal organization. In the wonderful host of antarctic animals, not one will be found which is an inhabitant of th northern seas; and from the most rigorous comparison, the truth of the following position must be admitted, namely, *That there is not one single species of well known animal, which can be truly considered as cosmopolitan, that is common to all parts of the globe.*

Further, (and it is in this that the inexhaustible variety of nature is most apparent,) however imperfect an animal may be, it will be always found an invariable rule, that each class has a distinct region; they are fixed at certain stages; at least there they are found most numerous, and in the greatest perfection; and, as they are met with further from this point, the individuals gradually degenerate until the species altogether disappear. Take, for example, the sea ear, *(Haliotis Gigantea.)* In the polar seas, it attains the length of six or seven inches, and there it forms the valuable banks which furnish food for man. Pass through the Straits of Dentrecasteaux, and we find the size considerably diminished. At King's Island, it is still smaller, and more rare; and it progressively diminishes in size, and its rarity increases; and the type of the largest shell fish of Van Dieman's Land, is hardly to be recognized in the productions of Nuyt's Land; and, by the time we get to King George's Sound, no traces of it are discovered.

It is the same with the *Phasianelles.* Their seat is at Maria Island. There, whole vessels might be loaded with them; and, like the *Haliotis Gigantea*, all traces of them are lost at King George's Sound, after having passed through insensible degradations.

I could easily adduce other instances, but what has been stated, is sufficient to prove, that the class of animals which originate in the cold latitudes, do not advance as far as the torrid zones, without specific alteration and degradation; and the converse of this position is alike true. No country that I have visited, is so rich in the variety and beauty of its *Testacei* as Timor: whilst there, I collected more than 20,000 shells, belonging to several hundred different species, and of this whole number, I never recognized one either in Van Dieman's Land, or on the southern parts of New Holland; and it was not till on the approach to the equatorial regions, that some of the species of Timor were observed.

It is not only with respect to species that this singular exclusion exists, but the same observations occur with regard to genera.

For instance, many genera abound near the equator, which are rarely met with on the colder shores of the two hemispheres; and, whilst at Timor, and the neighbouring islands, such hosts of shells, of infinite beauty and variety, are found, the whole southern coasts of New Holland do not produce more than two or three small inconspicuous species. At King George's Sound, the more splendid classes of Testacei reappear. They succeed, as it were, to the *Phasianelles* and Haliotis, forming the continuatio of the wonderful geographical chain of natural productions.

In this point of view, science appears to offer a new and brilliant field for speculation, and in which the naturalist will derive much assistance, from the outlines which have been so successfully pointed out by the divisions of *Geographical Zoology* of M. De Lacepède, and the works on *Hydrographical Zoology* of M. De Fleurieu—143, Vol. ii.

Art. XVII. *Asiatic Researches.—Vol.* XII.

An incomplete copy of the 12th volume of the Asiatic Researches, as yet unpublished, has reached us, through the kindness of Mr. Colebrooke, containing—

I. An account o the measurement of an Arc on the meridian, comprehended between the latitudes 8° 9′ 38″.39 and 10° 59′ 48″.93 north, being a continuation of the grand meridional Arc commenced in 1804, and extending to 14° 6′ 19″ north. By Major William Lambton, 33d regiment foot.

II. On the Maláyu nation, with a translation of its maritime institutions. By Thomas Raffles, Esq.

III. On the early history of Algebra. By Edward Strachey, Esq.

IV. An Account of the funeral ceremonies of a Burman Priest. Communicated by Wm. Carey, D. D.

V. An Account of observations taken at the Observatory near Fort St. George, in the East Indies, for determining the Obliquity of the Ecliptic in the months of December 1809, June and December 1810. By Captain John Warren, of H. M. 33d regiment of foot.

VI. On the notions of the Hindu astronomers, concerning the precession of the Equinoxes, and motions of the Planets. By the President.

VII. On the height of the Himálaya Mountains By the President.

VIII. An Account of the measurement of an Arc on the meridian,

extending from latitude 10° 59′ 49″ to 15° 6′ 0″.65 north. By Major William Lambton, 33d regiment of foot.

IX. Translation of a Sanscrit inscription, on a stone found in Bundélc'hand. By Lieutenant W. Price.

X. A Journey to Lake Mánasaróvara in Un-dés, a province of Little Tibet. By William Moorcroft, Esq.

We are not at present enabled to lay before our readers an analysis of the contents of the whole of this interesting volume; we shall, however, give a short extract from the seventh article.

The great central chain of Asiatic mountains, called *Himálaya*, supposed the *Mons Imaus* of the ancients, being inaccessible, by its situation in the midst of nations with which we have had little intercourse, has been hitherto almost unknown. These mountains have, however, been long believed, in India, to rival, if not surpass in height, all other mountains in both hemispheres. Some evidences of the fact, taken from the narrative of a journey performed by Lieutenant Webb and Captain Raper, have already been published, (As. Res. II. p. 445;) but from further examination of the measurements taken by those gentlemen, compared with some other measurements, the writer of the memoir from which the present article is extracted, considers it now ascertained, that these mountains greatly exceed in height the loftiest peaks of the Andes. We have heard that the hero of natural science, the indefatigable M. Humboldt, intends to explore this range of mountains; and we wait with impatience for the result of his enterprise. In the meantime, our readers will be gratified by a concise statement of the method by which the heights of these mountains have been computed, and of the results of the calculations,

The Himálaya chain is visible from Patna, on the southern banks of the Ganges, as a continued well-defined line of white cliffs, extending through more than two points of the compass, at a distance of about 60 leagues, while, at an equal distance, Chimborago, the highest of the Andes, is seen as a single point, the rest of the Cordillera being invisible. It appears, from Captain Turner's account, that the Peak of Chamalasi, near which he passed, after crossing the frontier of Thibet, is the same mountain which is seen from various sta-

tions in Bengal, the most remote of which is not less than 232 English miles distant. This, in the mean state of the atmosphere, requires an elevation of 28,000 feet, though less may suffice, under circumstances of unusual refraction.

The President himself observed the usual altitude of a peak of the Himálaya to be 1° 1′, as viewed from a station in Bengal, distant, according to Rennell's map, not less than 150 English miles, which, after a due allowance for terrestrial refraction, would give a height of not less than 26,000 feet. According to the mean of several observations of a peak, taken by Lieutenant Colonel Colebrooke, from two stations in the Róhilkhand, namely—Pilibhít and Jét'hpùr, allowing $\frac{1}{11}$ of the contained arc for terrestrial refraction, (which seems about sufficient, on the authority of Delambre, Legendre, and Maskelyne,) its height, above the level of the plains of Róhilkhand, is 22,291 feet, or about 22,800 feet above the level of the sea. It appears, however, from some observations of Major Lambton's, that the medium of the terrestrial refraction in India, it varying from $\frac{1}{4}$ to $\frac{1}{18}$, is about $\frac{1}{8}$; and the different heights in this memoir are computed at both these, and various other rates of refraction. Many more exact observations than the foregoing, made by Colonel Crawford, at Cat'hmándu, in 1802, are stated to have been communicated by him to the President: and another more numerous set, by the same gentleman, is mentioned as being probably now in England.*

According to the observations communicated to the president, Mount Dhaibún is 20,140 above Cat'hmándu, which is itself more than 4500 above the level of the sea; and another exceeds the elevation of the same station, by 17,819 feet—

* Colonel Crawford proceeded, by taking the angles of several selected points, of which he determined the distances by trigonometrical measurement, having taken the bearings from various stations in the valley of Népal, the relative situations of which were ascertained by a trigonometrical survey, proceeding from a base of 852½ feet, carefully measured four times, and verified by another base of 1582 feet, measured twice. The positions of the same mountains were also settled by observations of them made from the plains of Behar, among observations last referred to.

another by 20,025—another by 18,662 feet. All these are visible from Patna, the nearest being nearly 170 English miles distant, and the farthest about 226 miles.

The Dhawalagiri, or white mountain, supposed to be situated near the source of the Glandac River, was found, by observations of bearings, taken by Mr. Webb, from four points, and of altitudes from three, to be, (allowing $\frac{1}{8}$ for refraction,) 26,784 feet; and allowing $\frac{1}{11}$, 27,551.

Supposing the errors arising from refraction, and those from observation, to be the highest possible, and both in *excess*, the President calculates that its height, above the Plains of Gorakhpur, cannot fall short of 26,462 feet, or 26,862 above the level of the sea. The accuracy of the above mode of computation, is, in some degree, proved, by shewing the agreement, within a few hundred feet of its result, with those of other methods in the case of Mount Blanc.

A barometrical measurement is given, of the height of several mountains of an intermediate chain between the nearest accessible mountains and those of the Himálaya, which were used in the computation of the height of the latter. The folling measurements are given by the writer as near approaches to the truth.

Dhawalagiri or Dhólágír, above Gorakhpur, which is estimated to be 400 feet above the level of the sea,

On a mean of two nearest observations, and at the lowest computation, . . . English feet	**26,462**
On a mean of three observations, with middle refraction,	**27,677**
Above the sea, at the lowest computation, .	**26,862**
Yamunávatári, or Jamautrí, above the summit of Nagúnghatí, which is estimated to be 5000 feet higher than the sea, ...	**20,895**
Above the sea, . . .	**25,500**
A mountain, supposed to be Dhaibun, about Cat'hmandú, which appears, by a barometrical measurement, to be at least 4600 feet higher than the sea, . .	**20,140**
Above the sea, ...	**24,740**
A mountain not named, observed from Pilibhít and Jét'hpúr, above Rohilkhand, which is estimated at 500 feet above the sea.	
On a mean of observations at both stations, 22,291, or more exactly, . . .	**22,268**

Above the sea, . . English feet	22,768
A mountain not named, observed from Cat'hmandú, and situated in the direction of Calabhairavi, above the valley of Népal, 4600 feet higher than the sea, . .	20,025
Above the sea, ...	24,625
Another near it, above the valley of Népal, .	18,662
Above the sea, ...	23,262
A third in its vicinity, above the valley of Népal, .	18,452
Above the sea, ...	23,052

Art. XVIII. *An Abstract of an Account of the White Mountains. By* Jacob Bigelow, *M. D. from the New England Journal of Medicine and Surgery.*

The subject of this Paper is to detail the observations made by a party at Boston, who visited the White Mountains in the month of last July. The term mountain and hill, are words altogether relative in their signification. Thus, the surface of the lake of Lausanne in Swisserland, is higher than any mountains in the United States: and the city of Riobamba in Peru, is built on an elevation more than twice as great.

In the United States, exclusive, or possibly inclusive, of Louisiana, the highest point or ridge of land is undoubtedly that of the White Mountains in New Hampshire. From the earliest settlement of the country, these mountains have attracted the notice of the inhabitants and of mariners along the coast, by the distance at which they are visible, and the whiteness of their appearance during three quarters of the year (being then covered with snow). They were for a long time the subject of fabulous representations; the Indians had a superstitious dread of them, and travellers who occasionally ascended their summits, returned with exaggerated reports of the difficulty and distance as well as of the strange productions found on the more elevated parts of their surface.

These mountains are situated in latitude about 44° 15′ N. and longitude, 71° 20′ W. from Greenwich; and are distant about 150 miles from Boston.

The party approached them from the north-west, near the

town of Lancaster, on the Connecticut river, 25 miles from their base. Thirteen miles from their base, the White Hills presented the appearance of a continued waving range of summits of which it was difficult to select the highest. At Rosebrook's, (within four miles and a half,) the view of them was very distinct: the character of the summits was clearly discerned, five or six of which were entirely bald, and presented the appearance of a grey and ragged mass of stones towering above the woods, with which the sides and base were clothed In several places a broad continued stripe descended the mountains, having the appearance of a regular road cut through the trees and rocks from near the base to the summit. On examining these with a telescope they were found to be channels of streams, and in several places the water could be seen dashing down the rocks.

In a plain near the base of the mountains was a pond of one or two acres, situated near the road, and having no other inlet or outlet, appeared to be the principal source of the Saco river. The waters of this stream being collected from several sources, proceed directly toward the side of the mountain. At the point where, to all appearance, they must be intercepted in their course, there occurs one of the most extraordinary features of the place, well known by the name of the Notch. The whole mountain, which otherwise forms a continued range, is here cloven down quite to its base, affording a free opening to the waters of the Saco, which pass off with a gradual descent toward the sea. This gap is so narrow that space has with difficulty been obtained for the road, which follows the course of the Saco through the Notch to the eastward. In one place the river disappears, being lost in the caves and crevices of the rocks and under the shelves of the adjoining precipice, reappearing at length at the distance of some rods below. The Notch gradually widens into a long narrow valley.

There is no part of the mountain more interesting than the scenery of this natural gap: the crags and precipices on both sides rise at an angle of great steepness, forming a support for the lofty ridges above. One of the most picturesque objects was a cliff presenting a perpendicular face, of great height, and crowned at its inaccessible summit, with a profusion of flowering shrubs.

For many miles below the commencement of the Notch, the eye meets on both sides a successsion of steep and precipitous mountains rising to the height of some thousands of feet, and utterly inaccessible from the valley beneath.

In some instances fire had run over the sides of the mountains, destroying the vegetation, and leaving the dead trunks of the trees standing like stubble in a field, and presenting a singular appearance of desolation for miles in extent.

The White Hills have been ascended by various routes. The course which is usually considered as attended with the least difficulty, and which was adopted by Dr. Bigelow and his party, is that which commences at the town of Conway, and follows the course of Ellis river, a northern branch of the Saco, which has its origin high in the mountains. After leaving the borders of cultivation, the course lies through thick woods, on a level, or with a gentle ascent, not much encumbered with an under growth of bushes, for six miles. The party encamped for the night at the mouth of the New river, a principal branch of the Ellis, which takes its name from the recency of its origin, which happened in October, 1775, when during a great flood which took place in consequence of heavy rains, a large body of waters, which had formerly descended by other channels, found their way over the eastern brink of the mountains and fell down toward the Ellis, carrying the rocks and trees before them in their course, and inundating the adjacent country. By this freshet the banks of the Saco were overflowed, cattle were drowned, and fields of corn swept away and destroyed. Since that period, the New river has remained a constant stream. From the encampment, which was seven miles from the top of the mountain, they proceeded the next day, two or three miles by the side of Ellis river, on a gradual ascent; then leaving the Ellis river for one of its principal branches called Cutler's river, leading directly towards the principal summit. After climbing by the side of the stream for a considerable distance, the trees of the forest around began to diminish in height, and they arrived at the second zone of the mountain. This is entirely covered with a thick low growth of evergreens, principally the black spruce and silver fir, which rise about the height of a man,

and put out numerous long horizontal branches closely interwoven with each other, and surround the mountain with a formidable hedge a quarter of a mile in thickness.

On emerging from this thicket the barometer stood at 25.93. giving the elevation above the sea at 4443 feet: they were then above all woods, and at the foot of what is called the bald part, which arose before them with a steepness surpassing that of any ground before passed, and presenting to view a huge, dreary, irregular pile of dark naked rocks.

Then crossing a plain, a gentle slope of a quarter of a mile, they began to climb upon the side. The ascent of half a mile was laborious, and performed by stepping from one rock to another, as they presented themselves like irregular stairs winding on the broken surface of the mountain. In the interstices of these rocks were occasionally patches of dwarfish fir and spruce, and beautiful tufts of small Alpine shrubs then in full flower. (*July*)

Having surmounted this height, they arrived at a second plain, which, like the first, was covered with withered grass, and a few tufts of flowers. There remained now to be ascended only the principal peaks, designated by the name of the Sugar Loaf, or Mount Washington. The day was uncommonly fine, yet the atmosphere was hazy, and the view of remote objects very indistinct.

The anticipations of the party were not realized in regard to several phenomena they had been taught to expect at the summit. The state of the air was mild; the thermometer stood at 57° Fahr. on the summit: at 12 o'clock on the same day, at Conway, 25 miles distant on the plain below, it was at 80°. The snow lay in patches of an acre in extent upon the sides, but appeared to be rapidly dissolving. They were not conscious of any material alteration in the density of the atmosphere, as neither sound nor respiration were perceptibly impeded. Instead of an absence from these barren regions of animal and vegetable life, multitudes of insects buzzing around the highest rocks, were found, and every stone was covered with lichens, and some plants were in flower in the crevices within a few feet of the summit. The ascent from the encampment at the mouth of New river, including rests, had employed six hours and an half.

The great distance at which these mountains are visible, and apparent length of their ascent, led to estimates of their height, considerably exceeding the probable truth. A mountain barometer of Englefield's construction, stood on the summit, at noon, at 24.23; the thermometer being at 57°. On the same day at Cambridge, this barometer stood at 29.95. and the thermometer at 76°; this difference of the barometer, after making the necessary corrections, would give, according to Sir H. C. Englefield's formula, a difference of 6230 feet in the altitude of the two places. The uppermost or bald portion of the mountain, (1800 feet in height), was found to consist wholly of a loose irregular disconnected heap of rocks.

Gneiss and micaceous schistus, or rather an intermediate substance between the two, prevailed. The mica is abundant and brilliant, but its stratification, uneven and irregular, and often interrupted by thin strata of quartz. Owing to the irregular position of the rocks, the strata were found resting in every possible direction. Large veins of quartz very frequently traversed them, and specimens of pure mica, the plates of which are several inches in diameter, were occasionally obtained.

In the middle and lower parts of the mountain, the micaceous slate appeared to be more perfectly formed, and the strata were remarkably smooth and even, and their fissure presenting the most brilliant silvery lustre. The bed of the cascade at New river, was principally of this material, intersected by thick veins of quartz, which contained large chrystals of schorl. The pebbles in the streams were chiefly of micaceous slate, and occasionally of gneiss, granite, and pure white quartz. They also met with hornblende containing traces of carbonate of lime. In some places where the geology of the mountain was exposed, the lower strata were of green-stone and green-stone slate, with some granite. Higher up, granite and gneiss prevailed; the green-stone is fine grained, containing pyrites; the green-stone slate contains actinole; the granite contains emerald tourmaline, white quartz, and feldspar, white and reddish mica, and garnets of different sizes: the granite is distinctly stratified. The strata of these rocks are from six inches to many feet in thickness, the granite being thickest; generally two or three feet;

the dip of the strata is small, and from the mountain. The rock on the summit, and for some hundred feet below, was gneiss, afterwards granite prevailed. Near the Notch the rocks were of coarse reddish jasper, and porphyry.

The vegetation of the White Hills has been divided with propriety into three zones. 1. That of the common forest trees; 2. that of dwarf evergreens; and 3, that of alpine plants.

The woods which extend from the base up the sides to the height of about 4000 feet from the sea, consist of the rock maple, the silver fir, the hemlock, the black and white spruce, the white pine, the beech, the black, yellow, and white birch; the underwood was composed principally of the Viburnum lantanoides, the Acer montanum and striatum, and Sorbus americana. On the ground was the Oxalis acetosella, beyond every other species of plant, Dracena borealis, Cornus canadensis, Gaultheria hispida, &c.

Where the hispida forests terminate the second zone of the mountain immediately commences, the line between them being very distinctly drawn. This region consists of a belt of the black spruce and silver firs rising to the height of 7 or 8 feet; upon the ground under the ever-green trees, there were but few other vegetables; the Houstonia cærulea, and Cornus canadensis were found in flower.

Above the zone of firs, which terminates as abruptly as it began, is a third or bald region, wholly destitute of any growth of wood; yet to the botanist this is by far the most interesting part of the mountains. Many of the plants of this region were rare, and not to be found in the region below, being for the most part natives of cold climates and situations, such as are found in high latitudes, or in great elevations. Among them were natives of Siberia, Lapland, Greenland, and Labrador. Vegetables of this race, usually known by the name of Alpine plants, have always been found difficult of cultivation, being impatient of drought, and of both the extremes of heat and cold. During the severity of the winter, in their native situations, they are preserved from injury by the great depth of snow under which they are covered, which secures them from the inclemency of the air, while they partake the temperature of the earth below

them. When the snow leaves them, which frequently does not happen till the middle of summer, they instantly shoot up with a vigour proportionate to the length of time they have been dormant, rapidly unfold their flowers, and mature their fruits; and having run through the whole course of their vegetation in a few weeks, are again ready to be entombed for the rest of the year under their accustomed covering of snow. These plants, notwithstanding the high and barren elevations at which they frequently grow, do not suffer for want of moisture, being constantly irrigated by the clouds which embrace them, and by the trickling of water over their roots from the eminences above.

The vegetation in spots extended quite to the top of the mountain. Diapensia lapponica and Lycopodium lucidulum, (the former in full flower) were growing within six feet of the summit. All the rocks were incrusted with lichens, among which Livelleus is the one which predominates, and contributes essentially to the dark gray appearance of the mountain.

In the list of vegetables enumerated by Dr. Bigelow, a considerable number of species are natives of Europe, as well as of America. A question of some interest has arisen whether any plants are originally common to both continents,* and whether those species which approach each other so nearly in their external characters as to be known at present by the same names, are in reality the same species. The analogy of the animal kingdom seems to favour the negative of this question. M. Humboldt has asserted, upon the highest authorities, that no quadruped or terrestrial bird, and even that no reptile or insect, has been found common to the equinoctial regions of the old and new world. In like manner he affirms, that the phænogamous plants which have been recognized as natives of the tropical regions of both continents are extremely few. In the temperate zones, the number of American plants which wear European names, is continually diminishing in books. The separation of them has in some instances been carried further than a strict adherence to the present grounds of botanical distinction will justify. Yet there still remain species wholly

* Humboldt's Memoir on the Distribution of vegetable Forms.

agreeing in their botanical characters, but sufficiently differing in their qualities, places of growth, times of flowering, &c. to render it not improbable, that they are distinct. There is a species of æthusa, grows about Boston, which externally bears the strictest comparison with æthusa cynapium of Europe. It is, however, altogether destitute of the nauseous or garlic taste for which that plant is noted. Menyanthes trifoliata, in New England, flowers a month earlier than in Great Britain, though the seasons in Boston are perhaps always more backward. Botanists have not yet distinguished the chestnut tree of America from that of Europe, although its wood is weak and brittle, and never used, as in Europe, for hoops and other purposes where strength and tenacity are required. On ground like the foregoing, a great number of vegetables which have not emigrated since its discovery, and which are not found far to the north of that country, may be suspected, observes Dr. Bigelow, of being really distinct in nature from those which nearly resemble them in Europe, and are known by the same names.

But as we approach toward the north, and arrive in high latitudes, the probability of finding plants identically the same, is greatly increased. About the arctic circle, the two continents approach each other so nearly, and are so connected by ice during part of the year, that they may, as far as botany is concerned, be considered the same country. The same plants may be equally disseminated on both, and these may extend as far towards the south as the general coldness of the climate suited to their constitution continues. Beyond this they may, for some distance, be found in alpine situations on the tops of the highest mountains. There are also plants of such versatility of constitution, that they bear all the varieties of climate from Hudson's Bay, to Virginia and Carolina. Such plants may well be common to the two continents.

Art. XIX. *An Account of the Earthquake of Caraccas. By M.* Palacio Faxar.

The ridge of mountains, which branches out from the Andes near the isthmus of Panama, and which, taking the direction of the eastern coast, crosses part of New Granada, and Venezuela, seems to have been the seat of that earthquake, which on the 26th March, 1812, destroyed many populous towns of the province of Caraccas. It is this branch of the Cordilliera that forms the Sierra-nevada of Chita, that of Merida-de-Maracaybo, and the height called La-Silla-de-Caracca; and it is between these three remarkable points that the mines of gold of Pamplona, the mineral water of Merida-de-Maracaybo, and the mines of copper of Aroa, are found. Between the picturesque Sierra-nevada of Merida-de-Maracaybo, and La-Silla-de-Caracca, where spring is perpetual, the earthquake was most strongly felt.

At the south-east of this ridge of mountains, there are plains of an immense extent, covered with different species of grasses, and watered by innumerable torrents, which falling from the mountains, and uniting in different bodies, majestically enter the Orinoco. These plains were likewise convulsed for above one hundred and twenty leagues in Venezuela: the towns situate immediately at the foot of the Cordilliera, or in the valleys between them, suffered most severely: those seated in the plains did not suffer considerable injury, though violently shaken. For five months a continued drought had parched the earth, no rain having fallen, and in the preceding month of December, a slight shock of an earthquake had been felt at Caraccas. It was on the eve of the Crucifixion, when Catholics assembled together in their churches to commemorate with public prayers and processions the sufferings and merits of their Redeemer, that this sad catastrophe happened. The weather was fine, the air serene, when between four and five P. M. a hollow sound like the roar of a cannon was heard, which was followed by a violent oscillatory motion from west to east, which lasted about

seventeen seconds, and which stopped all the public clocks: the convulsion diminished for some moments, but was succeeded by a more violent shock than the first for twenty seconds almost, keeping the same direction : a calm followed, which lasted about fourteen seconds, after which the most alarming trepidation of the earth took place for fifteen seconds. The total duration about one minute and fifteen seconds. The inhabitants of Caraccas, struck with terror, unitedly and loudly implored the protection of heaven; some ran wildly through the streets; some remained immoveable with astonishment; while others crowding into the churches, sought refuge at the foot of the altar. The crash of falling buildings, the clouds of dust from their ruins, which filled the air, the anxious cries of mothers, who enquired in vain for their children lost in the tumult, increased the horrors of this sad day. To this scene of disorder succeeded the most horrible despair. Dead bodies, wounded persons crying for protection presented themselves every where to those who had escaped from the catastrophe, and who could not turn their eyes from these objects of pity and horror, without meeting with heaps of ruin, which had buried hundreds of unfortunate persons, whose lamentations uselessly pierced their hearts, for it was impossible to give relief, or assistance to all.

It has been computed that in this calamitous day, near twenty thousand persons perished at Venezuela. A great part of the veteran troops were of this number; and all the arms destined for the defence of their country were buried under the ruins of the barracks. The towns of Caraccas, Merida-de-Maracaybo, and Laguaira were totally destroyed; those of Barquirineto, Sanfelipe, and others suffered considerably. It is to be remarked that Truxillo, which is situate between Merida-de Maracaybo, and Sanfelipe, experienced very little damage. At the last place, near the mines of Aroa, the first signal they had of the earthquake was an electric shock, which deprived many persons of their power of motion; and in Valencia, Caraccas, and the neighbouring country the inhabitants were for about twenty days after the earthquake, in an extraordinary state of irritability. Many persons, who suffered from intermittent fevers, recovered immediately in consequence of the effect of the earthquake.

At Vallecillo, near Valencia, a rivulet spouted' out from a hill, which continued to flow for some hours after the earthquake, and which I visited a few days after. The river Guaire, which runs through the valley of Caraccas, was greatly swelled soon after the earthquake, and remained in that state for several days. The water of the bay of Maracaybo withdrew considerably, and it is said that the mountain Avila, which separates Caracccas from Laguaira, sunk several feet into the earth.

The earthquakes continued for many days, we may say, without interruption: they diminished as it were by degrees, though the last were remarkably strong. So late as the month of October of the same year there was a violent shock. The earthquake of the 26th March was felt at Santafé-de-Bogotá, and even at Carthagena, though it was very little felt at Cumana.

In the following April a volcano burst out in the island of St. Vincent. About the time of the eruption, a noise like that of a canon was heard at Caraccas and Laguaira, which caused a general alarm, the inhabitants of each place supposing that the neighbouring town was attacked by the enemy. This roaring noise was distinctly heard, where the river Nula falls into the Apure, which is more than one hundred leagues from Caraccas. In the same year, 1812, many strong shocks of an earthquake were felt at Samaica, and Curacoa.

The earthquake of the 26th March alarmed so deeply the inhabitants of Venezuela that they expected to see the earth open and swallow them at every convulsion, and it having happened on the anniversary of their political revolution, made them suppose it had incurred the displeasute of the Almighty. The clergy, who were enemies to the revolution, as their privilege had been diminished by the new constitution of Venezuela, availed themselves of the disposition of the people, and preached every where against the new republic. Such was the beginning of the civil war at Venezuela; a war, which has desolated those beautiful countries, and which has destroyed the tenth part of their population.

M. PALACIO FAXAR.

London the 1*st December*, 1816.

Art. XX. *On the Restoration of Vision, when injured or destroyed in Consequence of the Cornea having assumed a conical Form. By Sir* William Adams.

Among the causes producing short sight, is a morbid thickening of the transparent cornea, which has been usually termed Conical Cornea. One of the first, and, I may add, the best descriptions yet given of it, has been by Doctor Léveillé, an eminent French physician, and translator of Professor Scarpa's work on diseases of the eye, into the French language.

The conical cornea, although a disease, not so frequently met with as many other morbid affections of the eye, is yet by no means of rare occurrence; and any curative effort which is capable of being successfully exerted, becomes the more interesting, the advanced stage of the disease, (as far as I have been able to learn,) having been hitherto considered by authors as incurable.

It is, therefore, highly gratifying, that the resources of art are found competent to afford effectual relief even in this apparently hopeless case, in which, although it is impossible to remove the disease itself, when thus fully formed, yet, by taking away one of the healthy parts of the eye, whose use is similar to that of the diseased growth of the cornea, (which does not admit of removal,) vision, it will be shewn, may be restored nearly to perfection.

The malady in question commences by a morbid growth of the whole substance of the cornea, without inflammation or opacity, but more particularly its central part, situated opposite to the pupil, and the patient's degree of short sight increases in exact proportion to this growth. Its advance, unless arrested by the appropriate medical treatment, is usually slow, but progressive, until, at length, the cornea, instead of being a regular segment of a sphere, wholly losing its natural curvature, assumes a conical form. This change of structure produces some curious phenomena in the appearances as well as the uses of the cornea. On examining this tunic in front,

it assumes an unusual degree of sparkling brilliancy, nearly resembling crystal, except, (as is sometimes the case,) where there is an opacity in the apex of the cone. Doctor Léveillé attributes this brilliancy to the cornea's strongly reflecting, instead of transmitting, the rays of light, by which he supposes, that the pupil becoming contracted, in a strong light, thereby producing an imperfect and confused sight.

This explanation of the cause of the patient's imperfect vision, it will, however, be hereafter shewn, is erroneous. If the cornea be examined laterally, the thickening, it will be observed, gradually increases from its circumference to its centre, where the apex of the cone is usually seated, although, in some instances, I have seen it on one side of the centre. When the cornea is similarly examined, opposite to a strong light, its thickness at the base may in general be traced, while the sugar loaf form of the apex renders it impossible to be mistaken for any other disease of the eye.

The change which this disease produces, in respect to vision, is very important. Soon after the commencement of the diseased growth, the patient complains of being unable to see objects distinctly, at the usual distance; and his power of vision becomes gradually shortened, in proportion as the disease advances, until, at length, he is unable to perceive minute objects with any degree of distinctness, however near they may be placed to the eye; and cannot make out large ones when above three or four feet distant. In fact, vision is destroyed in relation to the useful purposes of life, and he becomes nearly as dependent as if totally blind. Indeed, I once saw a young lady labouring under this disease in both eyes, who did not venture to go any where without a guide.

The disease generally begins at the first in one eye, and a similar affection most commonly succeeds in the other. I have met with it in almost every stage of life, from a girl of sixteen to an old lady of seventy, and am not aware that it is peculiar to any sex or age, although I have certainly seen it much more frequently in women than in men, and more in young than in old persons.

The opinions generally entertained of the cause of the

case in question, appear to me to have been incorrect, and have necessarily led to an erroneous practice, in the attempts which have been made for its alleviation. The conical form of the cornea has been atributed to an over-distention of that tunic, occasioned by a superabundant secretion of the aqueous humour, which, continually stretching the cornea, has gradually occasioned it to yield to the pressure from within, and thus produced the alteration in its form. To remove this supposed over-distension, it has been usually recommended to evacuate the aqueous humour, by puncturing the cornea, and afterwards to employ pressure—astringent collyria, &c. to prevent its reaccumulation. Experience has, however, shewn the total inutility of these modes of practice. The operation of evacuating the aqueous humour has been, in some instances, repeated several times, without any permanent advantage being found to result from it; and, although it is an operation neither painful nor difficult to perform, yet is sometimes dangerous; for if the crystalline lens should be wounded by the instrument with which the puncture is made, cataract will most likely ensue; and I have been informed of a case, where this actually occurred, during the attempt to evacuate the aqueous humour.

Having, at an early period of my practice, been impressed with the opinion, that the conical form assumed by the cornea in this disease, was the effect of a morbid growth of that tunic; and that the short sight experienced by the patient, was to be attributed to its increased refractive power, and which, together with part of the crystalline lens, brought the rays of light to a point far short of the retina, it occurred to me, that as it was impossible to remove the morbid growth of the cornea, without rendering it unfit for the transmission of light, a useful degree of vision might be restored by the removal of the crystalline lens. I was the more strongly led to form this conclusion, after having myself tried the experiment of looking through deep convex spectacles, such as are employed by patients after the removal of cataract, which, I found, produced a confusion of sight, very similar to that

which I had heard described by persons in whom the cornea had been conical in the extreme degree. I, therefore, resolved, more than six years since, while surgeon to the West of England Eye Infirmary, instituted at Exeter, to remove the crystalline lens in a case in which that body had become opake, and also affected with conical cornea. Some circumstances, however, prevented the patient, who was a young woman, and a pauper, from being sent to me to the Infirmary. About three years since, another patient, from the country, an old woman, nearly seventy years of age, placed herself under my care, labouring under this disease, accompanied with cataracts, in whom I successfully removed both the cataracts, and had the gratification to find her vision thereby restored to an extent which far surpassed my most sanguine expectations. I observed that she was capable of seeing much more distinctly without convex glasses than is usual for persons who have undergone the operation for cataract, while, with a convex glass, she could read small print without any difficulty. Not being able to ascertain the degree of vision which this patient experienced previously to the puncture of the cataracts, nor whether the diseased change was going on in the cornea and crystalline lens at the same time, I necessarily cannot state the exact amount of the benefit which she derived from the operation. This, however, was demonstrated—that, by the removal of the crystalline lens in eyes affected with conical cornea, nearly perfect vision was restored; while, it is well known, that in cases of conical cornea, where no cataract exists, vision is usually as imperfect as if the latter malady formed a part of the patient's disease.

The favourable result of this operation fully confirming the opinion which induced me to perform it, I determined, at the earliest opportunity, to try the effect of removing the crystalline lens, as a remedy for blindness produced by conical cornea. A favourable case presented itself the following year, in a young woman, who, during six years, found her sight gradually decreasing, and, at the expiration of that period, had become so blind, from this disease, as to be unable to continue

her employment as a servant, and was in consequence obliged to apply for parochial maintenance. Shortly afterwards she was sent to an Eye Infirmary in London, where receiving no benefit, she was subsequently brought to me, and solicited in the most urgent terms the trial of any practice, which afforded a prospect of restoring her to sight. I carefully examined her eyes, and found that the cornea of both eyes had assumed the conical form in a great degree, attended by a slight opacity in the apex of each cone, but none whatever in the crystalline lens. She could walk without a guide, and could see at three or four feet distance, so as to avoid running against any person, but had entirely lost the power of reading, or perceiving minute objects, however nearly they were placed to the eyes.

I effected the removal of the crystalline lens, by causing it to be absorbed, which method of operating is to be preferred to every other hitherto practised, whether the lens be opake or not, in cases where, like the present, it admits of being freely divided. The patient, however, returned to the country before the eye had entirely recovered from the operation, and I did not see her again until nearly twelve months afterwards, when I was in the highest degree gratified to find her capable of discovering minute objects, and reading the smallest sized print, without the assistance of a glass, while holding the book at the usual distance of ten or twelve inches from the eye, nearly as well as she ever recollects to have done. The usual cataract spectacles for near objects, of two inches and a half focus, confused her sight nearly in the same manner as before the crystalline lens was removed, while with those of nine or ten inch foci, her capability of seeing minute objects was somewhat improved. She saw objects at a distance better without than with any glass I could find; whereas the usual standard for distant vision, after the operation for cataract, is four inches focus. She now neither uses a glass for near nor distant objects, has again returned to service, and a gentleman told me, who has recently seen her, that she accurately described to him an object which was considerably more than a quarter of a mile distant. Twelve months after undergoing

this operation, I operated upon the other eye, but she again left town before the eye had recovered itself, and before the lens was entirely absorbed. Previously, however, to her departure, she could read small print with this eye, by the assistance of a convex glass of two and three quarters inches focus, while with one of nine inches focus the sight was greatly improved in viewing distant objects.

As the degree of conical form of the cornea appeared to be the same in both eyes, and as the patient was equally blind in both eyes before the operations, it is a curious circumstance, and deserving notice, that the two eyes should require glasses differing so much in their refractive power. Not being able to obtain any other information from the patient as to the progressive amendment of her vision, during the twelve months she remained in the country, between February 1815 and February 1816, when she underwent the operation upon the second eye, except "that her sight continued to get stronger," (an indefinite mode of expression made use of by poor people in their recovery from almost every species of diseased eye) I cannot undertake to afford any authentic data for the hypothesis which I venture to offer as an explanation of this phenomenon. It appears to me that the greater degree of improvement of vision in the eye first operated upon, might be occasioned by the increased susceptibility of the retina from the exercise of that organ, and the power the eye had acquired of adapting itself to see near and distant objects distinctly, during the interval of twelve months the patient was absent; whereas the trial with the two and three quarters convex glass for near objects, and nine for distant ones, on the eye last operated upon, was made only a few weeks after the operation, and even before the attendant inflammatory action had subsided, or the whole of the lens become absorbed. I am led to adopt these opinions from observations made in numerous instances upon persons who have successfully undergone the operation for cataract, and who almost uniformly require deeper convex glasses to see distinctly immediately subsequent to the operation, than are necessary afterwards. That the retina and optic nerve become partially insensible from not

being exercised, and acquire their natural susceptibility when again brought into use, are facts which I have so often witnessed, that I judged them sufficiently confirmed to insert them in my practical observations on diseases of the eye; and I have also generally observed, more particularly in poor persons, who from the inconvenience attached to wearing spectacles, appear to feel an objection to their use, that although they are unable to see either near or distant objects immediately after the operation, without glasses, yet, after a time, they acquire the power to a considerable degree of perfection, if they have the patience to do without them. I cannot elucidate these opinions better, than by instancing three cases which have occurred in the extensive opportunities I have had of making similar observations among the patients on whom I have operated for the cataract.

The first was a postillion who had been blind nine years in one eye, and three in the other. Both cataracts were successfully removed by the operation effecting their absorption, and when he resumed his employment as a postillion, he was, from necessity, obliged to wear his spectacles, not being able even to walk without them; but finding that his passengers were frequently apprehensive of their safety, from being driven by a person requiring spectacles, he by degrees left them off altogether in the day, and in the course of twelve months he could drive quite as well without as with them. At night, however, when the rays of light being comparatively few in number, required the most complete concentration upon the retina, to produce a sufficient impression upon that membrane for the purposes of vision, he still derived great advantage from the use of distant sight spectacles. The poor fellow died of pleurisy about two years after the removal of the cataracts. Had he lived, it is probable the susceptibility of the retina would have so far increased, and the adjustive powers of the eye so much improved, that he would have seen even at night, sufficiently well without the use of any glasses.

While at Exeter I effected the removal of cataracts in a young man twenty years of age, who was born with them.

The cataracts were originally fluid, but, as is usually the case when this species is suffered to remain for any long period without being operated upon, the fluid first had become absorbed, leaving nothing but an opake capsule containing the grosser parts of the cataract. With the right eye he could see brilliant colours, and perceive light from darkness, but could not discriminate any object; with the left I found him capable of seeing objects at a distance indistinctly, and of distinguishing large sized letters when held in an oblique direction within two inches of his eyes, and with his back turned to the light. If, however, he attempted to read facing the light, he entirely lost this power, and under the most favourable circumstances, the sphere of vision was so circumscribed, that it did not include above three or four letters at a time. To my surprise, as soon as the eye had recovered from the operation, he was able, without spectacles, to see both near and distant objects with a degree of precision quite unusual without their aid. He returned home at the end of ten weeks (a fortnight only after a second operation, which was performed on one eye) and I did not again see him for about nine months, when I found him capable of reading and writing with *both eyes*, without the assistance of glasses, although with one of them he had never, previous to the operation, been able to discern objects from his birth.

I now engaged him as a footman, being perfectly competent to execute the usual duties attached to this station, except to judge accurately of distances; he could not at this time snuff a candle with certainty, or pour liquids into a small glass. He neither used spectacles to see near or distant objects by night or day, but he always held small ones more than usually near to his eyes when he wished to view them attentively, in doing which he knit his brows, and appeared strongly to exert the powers of the eye. He saw, to all appearance, at as great a distance as any other person, and was fond of viewing extensive prospects. The scenery about the Irish and Scottish lakes seemed to delight him exceedingly. Finding him however incorrigibly idle and inattentive, I was obliged to discharge him at the end of the first year, when his knowledge

of distances was so much improved, that in the service where he afterwards lived in the country, he for some time acted as coachman.

Two very extraordinary facts occurred in this case; first,—the patient's immediate capability of adjusting his eyes in viewing different distances; secondly,—his having so soon established the susceptibility of the retina of that eye in which he had not seen previously to the operation. The first may, I think, be satisfactorily explained by supposing that in his best eye, the power of adaptation had been acquired previously to the performance of the operation, for the crystalline lens having been opake, and nearly absorbed, was not only useless in effecting the natural refraction of the rays of light, but also actually impeded them in their progress to the retina, the only passage by which they could make their way to the bottom of the eye, being through the edge of the capsule, where it was less opake than in its centre. In the passage of the rays of light through this portion of the capsule, it is evident, very little, if any refraction, could take place, and it therefore required the adjusting powers of the eye to be exercised in order to enable him to see near and distant objects previous to the operation, quite as much, if not more than if the lens had been actually removed.

Thus, then, that power which usually takes a patient six or twelve months to acquire after the removal of the lens in ordinary cases, was possessed in this previously to the performance of the operation.

The small space at the edge of the capsule, through which alone the light was capable of making its way to the retina, explains the necessity of the patient turning his back to the light in order to effect a dilatation of the pupil, for when he faced the light, from the contraction of the pupil, the iris covering the greater part of the space in the capsule through which the light passed, necessarily occasioned a still greater diminution of vision than he previously experienced.

The same cause accounts also for his being obliged to hold small objects in an oblique direction, and for his seeing but three

or four letters at a time, for had the part of the capsule through which the light passed, been in the centre instead of at the edge, and also been of a large extent instead of being confined, he would consequently have seen objects straight forwards, and have possessed the power of taking in a much larger extent of vision. The opinion that the latter effect was occasioned by the small space through which the light had to pass is confirmed by my having generally observed, that where the pupil is naturally small, the field of vision is proportionally circumscribed. In one instance of a patient who came to me after he had undergone a number of operations for cataract, in a public Institution, I found the pupil so much contracted as to render it dangerous for him to walk in the streets by day, and entirely to incapacitate him from doing so alone at night. After forming an artificial pupil of a proper size, he was enabled to see even the nails of his fingers when the arms were extended to the utmost at right angles with the body, nearly as distinctly as he could before I operated upon him, when placed immediately before his eye, and he now sees to walk at night as well as other persons.*

With respect to that eye of my late servant with which he had never seen previous to the operation, and the retina of which so quickly acquired its susceptibility, it certainly was a very unusual circumstance; for, as I have already observed, and as will be fully exemplified in a case hereafter detailed, it in general requires a considerable time to restore by exercise the want of sensibility occasioned by its having long been dormant.

I have however, lately seen another similar instance to the contrary in a young man of thirty years of age, born with cataracts, with one of which, as in the above case, he never had seen more than to distinguish brilliant colours, and perceive light from darkness. The fragments of the cataract having, spontaneously become depressed immediately on the breaking up the lens, he instantly saw light much more strongly than he had done before. On the following day he saw all the objects around him, and at the expiration of a fortnight, when the eye

* See Plate II. and Case 10. in my work on Diseases of the Eye.

had recovered itself, he could, with the assistance of glasses, distinctly discriminate the minutest objects, even the seconds and minute marks, on my watch dial.

The third case is entirely opposite in its bearing to the two former. About seven years since, I operated upon a young gentleman born with partial cataracts. The centre of the crystalline lens was opake in both eyes, but the circumference in each was transparent, which afforded him an indistinct but very useful vision, he being able to read small Greek character, and to see distant objects, although not as far or as distinct as other people, yet sufficiently for general use. I removed the whole of the lens by the operation for absorption, when with the assistance of properly adjusted glasses, he saw with his best eye both near and distant objects to the utmost extent of his expectations and wishes; with the other, the retina of which had become insensible from never having been in the habit of exercising it, he could see but very little. After the operation he habituated himself constantly to use spectacles for distant as well as for near objects, and he is now at the end of seven years unable to avoid running against persons, or the furniture of a room, if he attempts to cross it without them; whereas, with spectacles, he sees sufficiently to have become an expert shotsman. There can be no doubt that the inability of this gentleman to see objects has arisen from his not bringing the adjusting powers of the organ into action in consequence of habitually using his two kinds of spectacles which effected the necessary refraction of the rays of light to see both near and distant objects, without occasioning any exertion of the eye, whereas if he had felt the same necessity of doing without them soon after the operation, as described in the case of the Postillion, he would unquestionably have succeeded equally well. It is also evident that by the removal of the crystalline lens, he lost the power which he previously possessed, of adjusting his eyes to different distances, although their partial opacity prevented his seeing either near or distant objects as well as other persons, and which power, owing to the habitual use of convex glasses, of $2\frac{1}{2}$ or $2\frac{3}{4}$ for near, and 4 or $4\frac{1}{2}$ for distant objects, he has not since re-acquired.

From a consideration of these three cases, am I not then jus-

tified in hazarding the conclusion that whatever power the crystalline lens possesses of adjusting the eye to different distances, yet, after its removal, there is another power of adjustment, which (as in the former cases) can be subsequently brought into action by exercising the organ without glasses, but which power (as in the latter) is not called into action when glasses are continually employed?

I have myself full confidence in this opinion, having, after the removal of the crystalline lens, almost uniformly witnessed similar results from similar exercise of the eye. The partial insensibility of the retina before spoken of, as a cause for the necessity of using a deeper convex glass soon after the operation, for the purposes of vision, than is afterwards required, cannot apply to the best eye of this gentleman; for to the period of the operation, he exercised it in the prosecution of his studies, while its necessity for the other, the retina of which had become torpid for want of being exercised, was strikingly exemplified, it being a considerable time after the operation, even with the assistance of the deep convex glass, before this eye had acquired any degree of useful vision. At the present time its powers are very inferior to the other, from being less employed in consequence of the patient's chiefly relying on his best eye.

In returning to the consideration of the case detailed of the young woman with the conical cornea, it may perhaps be supposed, that by admitting the susceptibility of the retina to have been encreased by its being twelve months exercised after the operation, and the adjusting powers of the eye to have been acquired from the same cause, that I abandon my opinion of the morbid degree of separation of the light in its passage through the thickened cornea, together with the natural refraction produced by the crystalline lens being the cause of the confused and imperfect vision previously experienced by the patient; this however is not the case, as the fact of the girl being capable of seeing after the removal of the lens, *which was not in the slightest degree opake*, after having been blind previously, shews clearly that the refractive powers (the conical cornea and crystalline) were too powerful, and that the cure was effected by the removal of one of them. But what I conceive proves the

accuracy of these inductions is, that in the earlier stages of the disease, when the thickening has not attained the height it had reached in the case alluded to, the greatest assistance is afforded to the patient's vision by the employment of common glasses. It is not, however, my intention to urge that the refractive power is equally great in the thickened cornea as in the crystalline lens; on the contrary, I think that a convex glass of a less magnifying power than that usually required after the removal of cataract, may be frequently employed to great advantage in cases of conical cornea: were any further arguments necessary than those adduced to prove that the short sight of the patient is occasioned by the morbid thickness of the cornea, and not from the superabundant quantity of the aqueous humour as has been supposed, it would be, the well-known fact that water possesses little comparative refractive power, while, from the dense structure and the form of this conical cornea, it is quite evident that its powers of refraction must be very considerably increased.

Although I may have failed in convincing my readers of the accuracy of some of the opinions which I have ventured to submit in this paper, yet I have the gratification of knowing that I have fully proved the important fact, of having successfully carried into effect a mode of treatment capable of restoring vision in a case incurable by other means, and which, as far as I have been able to ascertain, has hitherto never been employed by any other person.

ART. XXI. *Analytical Review of the Scientific Journals published on the Continent, during the preceding Quarter.*

JOURNALS PUBLISHED IN SWITZERLAND.

Bibliothèque des Sciences et des Arts.—Geneva. Monthly.

IN the last number of the Journal of Science, we merely announced the successive and rapid appearance of the Numbers

for January, February, March, April, and May, of the *Bibliothèque*, We now proceed to analyse the Numbers that have subsequently been published, and which more immediately fall within our plan of noticing the most recent publications. We begin, therefore, with the Number for June. It is needless to remind our readers, that the Journal under consideration is a *new* series of the well-known and justly esteemed periodical work, entitled *Bibliothèque Britannique*. In changing the name, however, the editors have also considerably altered their former plan and arrangement. The literary or scientific productions of Great Britain were the chief and almost exclusive subjects of their notice, in the former publication; and thus constituted, their Journal found its way into almost every corner of the Continent, where science and the belles-lettres are at all cared for; and where the great progress made by the English in both those branches of learning could not be known by any other means, in consequence of the obstructed communication between the Continent and our island.

In embracing, as they now propose, a wider field of observation, the editors have certainly given a new character to their publication—that of variety; but to support this to that degree of worth, which a select though limited miscellany possesses, more strength of talent, and other various qualifications, are required, than fall generally to the lot of two or three men, confined to a small capital, with every sort of difficulty besides that of the undertaking itself, before them. To give an accurate and satisfactory account of what is done in England, may come within the fair reach of the exertions of an intelligent editor; but when his attention is to be diverted by a variety of observations on the productions of every other country in Europe, it is to be feared that he will fail to do justice to his subject. "Cela tient à la nature des hommes."

JUNE.

Art. I. *Recherches sur l'Electricité atmosphérique. Par M.* Schübler.

In calm and serene weather the atmospheric electricity, according to our author, is constantly positive, subject, how-

ever, to two daily fluctuations. It is at its *minimum* a little before sunrise—it then gradually accumulates and reaches its *first maximum* a few hours afterwards (eight o'clock in May). At this period the electricity begins to diminish, till it has successively descended to its second *minimum.*

The second *maximum* of atmospheric electricity exists, in the evening, about two hours after sunset; it then diminishes, at first rapidly, and next, in a slower progression, during the whole of the night, to present again on the following day the same oscillations.

These regular fluctuations may be observed throughout the year; more easily in fine than in cloudy weather; and of a greater duration in summer than in winter.

The proximity of the two *maxima* of electricity in winter induced some meteorologists to believe, that there existed but one *maximum* during the cold season. This, of course, is an error.

The diurnal electrical fluctuations seem in no way influenced by the temperature; for although their first *minimum* takes place at sunrise, when the air is the *least* heated, the second, on the contrary, occurs at the period of the *highest* diurnal temperature. The hygrometrical state of the atmosphere, on the other hand, according to M. Schübler, seems greatly to modify its electrical oscillations; for the two *maxima* of the latter occur a little after sunrise and sunset, at which periods, the author thinks, that the air presents the greatest quantity of vapour. In endeavouring to explain this analogy between the atmospheric electricity and the hygrometrical modifications of the atmosphere, Mons. Schübler is not perfectly clear; at least *we* cannot understand him, since even the *expressions* employed, to account for such a phenomenon, are new to us, as applied to the present question.

But the theoretic part of observations, in themselves new, is seldom as interesting as the facts which may be deduced from them; and we find this opinion illustrated by Mons. Schübler's example. Thus the practical observations contained in his Memoir are both curious and interesting. For instance. When water falls in the state of rain, snow, or hail, it is electric,

and its electricity is superior to that of the atmosphere. The electricity is sometimes positive, and at other times negative.

Rain without any electricity occurs seldom. Such a phenomenon is only to be observed when the state of electricity of rain changes suddenly from positive to negative; or when the rain is very insignificant.

The electricity of rain is greater in summer than in winter, yet two showers succeeding each other at a short interval possess sometimes an opposite electrical state, though of the same degree of intensity. In the course of one year the positive electricity of rain has been observed 71 times, and the negative 69.

Snow is oftener positive than negative—as 24 : 6.

This Memoir is illustrated by two tables presenting the electrical variations of the atmosphere at different hours in the day—the state of the thermometer and of the weather—the march of the barometer and of the magnetic needle.

The observations of Mons. Schübler were made in the vallies of the south of Austria; and with Volta's apparatus of comparative electrometry.

Art. II. *Breve Notizia, &c. or Notice abrégée des Progrès de l'Astronomie en Italie dans les quinze premières Années de ce Siècle.*

This article is a translation from the Italian Journal published at Milan, which we have promised, and shall have occasion to notice in this Number.

Art. III. *Ephémerides Astronomiques de Milan pour l'Année bissextile* 1816, *calculées par M.* Carlini.—*Milan.*

It can be of but comparatively little interest to us, after having happily reached the conclusion of the *année bissextile,* to know what foreign astronomers may have said of it before its beginning. But amongst the articles of transitory importance contained in this work, we find others of a different description, which induce us to notice it, though in other respects out of date.

Amongst these are a continuation of the observations made

by A. Cesaris on the periodical oscillations of buildings, respecting which some experiments had been made, and their results published in the *Ephémerides* for 1815, whence it appears, that there is actually an angular movement = to 2″ in the walls of buildings, influencing, of course, the observations made with instruments attached or in any way connected with such walls—and that this phenomenon depends on the action of the sun's rays on buildings during fine weather.

The other interesting article is by the same author, and gives, amongst other important meteorological information, a very singular conclusion derived from observations, by which it appears, that the rain at Milan has been constantly augmenting from 1764 to the epoch at which the calculation was published. Thus between

	inch.	lin.
1764 and 1781 the mean was	32 .	11
1773 and 1790 ————————	32 .	17
1782 and 1799 ————————	34 .	11
1791 and 1808 ————————	35 .	8
1800 and 1814 ————————	38 .	9

Art. IV. *A System of Mineralogy.* B. R. Jameson, *&c.*

This is a review of the work thus announced, preceded by a general view of the present state of mineralogical science in Great Britain, in which the zeal of individuals, and the activity of the various Societies entirely dedicated to the cultivation of that science, are properly mentioned, and brought forward as a stimulus to others for imitation.

Art. V. *Medico-Chirurgical Transactions, Vol. VII. &c. &c.*

This is a translation of a remarkable case of apoplexy observed by Dr. Odier of Geneva, and read before the abovementioned Society last winter.

Art. VI. *A Memoir on Evaporation. By Mons.* Bellani.

We shall have occasion to speak of this paper when giving an account of the Italian Journal from which it is taken.

Art. VII. *Proceedings of the Royal Society of London, from April to 23d May.*

Art. VIII. *Proceedings of the Royal Society of Edinburgh, from April to the 1st of May.*

Art. IX. *Note sur la Marche progressive de l'un des Glaciers de la Vallée de Chamouny. Par le Prof.* Pictet.

The *glacier* in question is that of *Bossons*, the third on ascending the Valley of Chamouny. It has advanced, in some directions, about fifty feet, thereby creating some alarm among the neighbouring villagers.

JULY.

Art. I. *Traité de Physique expérimentale et mathématique. Par* J. Biot, *&c. &c.*

This is the third and last article of the review given in the Bibliothèque of this important work, which we have also promised to notice at a future period.

Art. II. *Considérations sur les Taches du Soleil, et Observations de celles qui ont paru l'Année dernière et celle-ci, recueillies par le Prof.* Pictet.

Mons. Pictet seems greatly alarmed lest the fortuitous coincidence of a cold and rainy season, and the appearance of some spots in the sun, should be mistaken for *cause* and *effect*, from which the imagination of *badauts*, and even *bons esprits*, might deduce the unwarrantable conclusion, that the sun may, in time, and that at no very distant period, become wholly incrusted, so as to plunge us at once into the unutterable darkness that characterised the primitive chaos. To prevent so much mischief, the Professor has taken great pains to shew—1st. That the solar spots cannot have had the least influence on the season; for, in that case, it would have been general, a circumstance which the accounts from Russia tell us not to have existed. 2d. That the spots in the sun are neither a new nor a rare phenomenon, for they have been observed repeatedly, ever since the invention of the telescope.

Having thus fulfilled the most benevolent part of his intention in writing the present Memoir, Professor Pictet proceeds

to the merely curious and scientific portion of his subject, in which he has the happiness of being materially assisted by the original observations of his friend and countryman, Mons. Eynard, senior—observations which are illustrated by appropriate diagrams in an annexed plate. M. Eynard has paid particular attention to the spots in the sun; so much so indeed, as to be almost inclined to suspect, from a calculation of their return, in reference to the earth, that the sun's rotation is subject to some acceleration. In his conclusions, however, he is perfectly accommodating. "For," says he, "whether we consider the sun's spots, according to Herschell, to be the mountains of the sun piercing through the luminous atmosphere which surrounds them—or whether we imagine, with Biot, that these spots are some enormous openings in the sun's body, from which torrents of fire are flowing;—it is equally certain, that no diminution of the luminous, and consequently of the calorific fluid, can ever take place." Good! But suppose neither of these opinions to be the right one, how is this astronomical phenomenon to be explained?—Mons. Eynard has not provided himself with an answer, in such a case; nor has M. Pictet supplied the deficiency.

Art. III. *Considérations sur la Nature des Causes qui maintiennent constante, la Proportion de l'Azote et de l'Oxigène dans l'Atmosphère. Par* Benedict Prevost, *Profes. de Philosophie, &c.*

The author had the curiosity, some years ago, to compare the weight of the atmosphere to that of a considerable mass of a very heavy substance,—such as a cubic league of gold, platinum, mercury, &c. He deduced from it the weight of oxygene, and by an approximate calculation he found, that the quantity which in a year combines with carbon, and forms carbonic acid, from all known causes is so extremely small, that even were it not replaced or again set free through the atmosphere, it would be impossible to discover its diminution by the means now employed.

The data and suppositions on which this calculation of Mons. Prevost is founded, are the following:

1. The earth is spheric—its radius = 3266600 toises.

2. The sum of all the surfaces of the continents and islands, above the level of the sea, is equal to one-fourth of the whole surface of the globe.

3. The mean elevation of the dry land all over the globe is = 2000 toises.

4. The constitution of the atmosphere is the same at all heights.

5. Abstraction is made of the diminution of gravity in the upper regions of the atmosphere.

6. Mean elevation of the barometer at the level of the sea, = 28 inches.

7. Specif. grav. of mercury, = 13.6.

8. The league at 25 to a degree = 2280,5 toises.

9. The water, carbonic acid, and other heterogeneous substances, commonly existing in the atmosphere, form $\frac{1}{50}$ of its weight.

10. 1000,000,000 men inhabit the surface of the earth.

11. Every man consumes daily two pounds of oxygene.

12. All other animals, comprising those which breathe the air in water, consume twice as much.

13. By the fermentation of vegetable earth, and combustion, a quantity of oxygene is consumed equal to that consumed by man.

By a calculation on the first eight suppositions, the weight of the atmosphere is found to be = that of 3986 cubic leagues of mercury; and if we consider the proportions of oxygene and azote, in volumes, in the atmosphere—their relative specific gravity—and the weight of the oxygene of the atmosphere, in reference to that of the azote (which is as 23 : 77), we shall obtain for the absolute weight of all the oxygene in the atmosphere a number equal to that of 900 cubic leagues of mercury.

Now four thousand millions of organic beings* consume in

* Since it has been found, from considerations of a physical nature, that the greater number of fishes, particularly those living at great depths, secrete instead of consuming oxygene, as some late

one hundred years (sup. 11.) 3×10^{14}, or three hundred thousand millions of pounds (marc) of oxygene (sup. 12 and 13.) A cubic *toise* of mercury weighs (sup. 7.) 205580 pounds. Therefore, 1,459,285,922 cubic toises of mercury would equal the weight of the oxygene consumed by the various causes already enumerated, in a hundred years. And as a cubic league contains about 11,860,000,000 cubic toises, the total weight of the oxygene consumed in one hundred years will be less than $\frac{1}{8}$ of a cubic league of mercury. Thus the diminution of the oxygene of the atmosphere in 100 years will be less than $\frac{1}{7200}$ of its total weight—a diminution which it is impossible to ascertain by the surest methods now employed.

Art. IV.

This is a continuation of the Review of Professor Jameson's System of Mineralogy. Second Edition.

Art. V. *Discorso sull' Uso della Mano destra a preferenza della sinistra.* *Par M.* Zecchinelli.

The most frequently occurring phenomena are usually those which we know the least about, and to which we pay the least attention. To what can we ascribe the generally prevalent custom of using the right in preference to the left hand? This is the problem which the author undertakes to resolve. According to his opinion it was necessary, in order to obviate a discordant mode of action which would have resulted from the right or left hand indifferently used, that one of the two should be selected, and employed generally, in preference to the other. This being once established, and of course during the earliest periods of society, the next consideration must have been the choice of the hand; and in this dilemma, mankind could not fail to discover, that the left hand, from its anatomical connection with the most vital and important parts of the animal economy, could not be the one to be pre-

experiments seem to prove, it will be necessary for Professor Prevost to make a fresh calculation, to render his present Memoir more exact.

ferred. For it must have been observed, that when the left arm is long used, or violently exercised, the left side also of the chest is put more or less in motion, and a consequent and corresponding obstacle produced not only in the free emission of the blood from the heart, but also in its progress through the aorta and its ramifications. Indeed the prevalence of the arterial system in the left side of the body renders this opinion quite plausible; and the painful sensations we experience when we agitate greatly the left arm, or attempt to run while carrying a weight in the left hand, proves, in a certain manner, the truth of Signor Zecchinelli's assertions. Dr. Odier has added some remarks to the above article.

Art. VI. *Proceedings of the Royal Academy of Sciences of Paris, &c.*

(See our last Number.)

Art. VII. *Proceedings of the Royal Society of London, from 13th of June to the 20th.*

Art. VIII. *Lettre au Profes.* Pictet *sur la Transmission de la Calorique, &c. Par M.* Carena, *Prof. de Physique de l'Academ. Royale de Turin..*

This letter contains the description of an experiment made with a view to ascertain, whether the contact of a metallic body can modify the conducting power of heat in glass. The experiment consisted in applying externally a disk of copper to one of the panes of glass of his window, during the severe winter of 1814, by which he was enabled to impede, upon that pane, the formation of those icy crystallizations which are deposited during cold nights, and which in his case had abundantly and brilliantly adhered to every other pane of glass of that window. A circumstance which tends to prove, according to Signor Carena, that the external metallic disk serves to prevent the transmission of the heat of the room through the glass. This fact, he says, must be attributed to a law of caloric as yet unknown.

Art. IX. *Lettre de Mons.* Raymond *de l'Académie de Turin sur le Photomètre de M.* Nicod.

The photometer in question was described in the fourth number of the *Bibliothèque.* It is simple in its construction, and particularly useful in its applications. Mons. Raymond having had occasion to use it, thought he remarked a slight defect, which he proposes to remedy by as slight a change in some parts of the apparatus. Our readers not being acquainted with the instrument itself, it would be needless to mention M. Raymond's proposed alteration.

AUGUST.

Art. I. *Aperçu des Progrès et de l'Etat actuel des Sciences dans les Etats Unis.*

This article is taken from the Transactions of the Literary and Philosophical Society of New York, Vol. I. 1815, where our readers may consult the original.

Art. II. *A Review of an elementary Treatise on Geometry. By Professor* Develey, *of Lausanne.*

In the present article it is said, that a Mons. *Bertrand* of that city was the *first* who restored to the science of geometry that precision and rigorous exactness, of which the ancients left us so many and fine models; that Mons. *Bertrand* is the only one who has established in an exact manner the theory of parallels; and finally, that Mons. Bertrand (of Geneva!), has published a work on geometry more complete, more exact, and certainly much more philosophical than that of Euclid! *Audistine tu unquam de Bertrando Genevensi?*

Art. III. *Extract of a Letter from Dr.* Olbers *of Bremen, on the Comet of last Year, &c.*

This is taken from the Philosophical Magazine for July last.

Art. IV. *Recherches physiques sur l'Iode, par le Profes.* Configliacchi, *de Pavie.*

As we shall have occasion to meet with the original of this Memoir in Brongnatelli's Giornale di Fisica, we will defer till

then to give an account of its contents. It was read before the Italian Institute.

Art. V. *Quelques Réflexions sur la Constitution physique des Corps, par le Professeur* Prevost.

In reviewing Mons. Biot's Traité de Physique, the editors of the Bibliothèque observed, when speaking of the physical constitution assigned to bodies in general, by that eminent philosopher, that it was analogous to the one which Mons. Le Sage *(notre savant compatriote)* had imagined before him. Mons. Biot's work is, we dare say, by this time in the hands of most of our philosophical readers; they have, therefore, an idea of his opinion on the physical constitution in question. In order, however, that they may perceive the analogy between that opinion and the one ascribed to Le Sage, we shall transcribe the following passage from the Bibliothèque itself. *Notre savant compatriote* "représentoit les corps comme des espèces de *cages*, dont les barreaux étoient aussi des *cages*, composées de barreaux qui étoient aussi des *cages*," &c. So on in arithmetical progression. Professor Prevost's aim in the present Memoir is to develop this notion of the *similarity* of the two opinions on the subject in question.

Art. VI. *Du Charbon végétal et de sa Base métallique, par* M. *le Prof.* Dobereirer.

The substance of this Memoir has already been laid before the British public. We know not whether the experiments have been repeated by any chemist, and whether the pretended metallic nature of charcoal has been observed by any other but Professor Dobereiner

Art. VII.

A continuation of the Review of Professor Jameson's System of Mineralogy.

Art. VIII. *Proceedings of the Royal Academy of Sciences of France.*

(See our last Number.)

Art. IX. *Proceedings of the Royal Society of London, from the 27th of June to the middle of July.*

Art. X. *Proceedings of the Royal Society of Edinburgh, for June.*

JOURNALS PUBLISHED IN FRANCE.

Journal de Physique, par M. De la Métherie.

JULY.

Art. I. *Phénomènes de Répulsion et d'Attraction sans Electricité, par* J. P. Dessaignes.

Mons. Dessaignes is one of the most zealous and indefatigable electricians of the age. His researches on the electricity of minerals have gone far beyond those of Haüy in importance; and we believe we owe to him the knowledge of this fact, that of the two electric poles of a prismatic mineral, the one having the greater number of faces is generally *positive.*

In the present Memoir the author asserts having observed the phenomena of attraction and repulsion in certain bodies, in which electricity seemed to have no part, though the phenomena themselves appeared to depend on the same fluid in which the electric power resides. These facts are accurately detailed; but we confess we could not discover the reason why the phenomena of positive and negative electricity produced, by plunging a stick of sealing wax or a glass tube into mercury, are not to be considered as common electrical phenomena. To attribute them to the fluid in which electricity resides, and to say that they are not electrical, as M. Dessaignes seems to insinuate, is, in our opinion, to play upon words, or at most to cut up or *mince* our present knowledge, limited as it is, of electricity, without any corresponding advantage. We wish, however, to speak with more respect of the last series of facts mentioned in this Memoir; and we should even be glad to see the attention of our electricians directed to them. The phenomena in this latter case seem as if produced by a fluid sometimes analogous to the magnetic; at others, of a particular nature: and it is not improbable, that by a continuation and consequent study of such observations, we should come to a better explanation of effects we are in the

habit of attributing to so many and so various causes. Mons. Dessaignes has found, that when a metallic disk, after remaining for a short time on a marble stand, is presented to an extremely sensible electrometric needle, the latter is sometimes attracted, at others repelled—and often stationary. The weather seems to influence the production of these curious effects, as well as the distance at which the disk is placed from the needle. Thus the attractive force is manifested at the distance of twenty-seven millimetres (1.02237 inches): while the repulsive force is at its maximum at eight or ten millimetres distance (.39371 inches). But the metallic are not the only substances which produce such effects under similar circumstances. M. Dessaignes has found that almost every substance he employed gave the same result with more or less intensity. When the air is cold and dry, if a metallic disk (more particularly) be exposed in the evening to the external atmosphere, and then presented, from time to time, to the electrometric needle, the latter is more or less attracted, according to the greater or less degree of cold of the air. If during this operation a current of colder air be established by the opening of a door, and directed to the disk, the phenomenon of repulsion succeeds to that of attraction. We suspect these facts, and the subsequent ones related by the author, to be greatly connected with the researches and observations of Mons. Schübler, of which we have given an abstract, in analysing the first article contained in the Bibliothèque Générale for June.

From the above results Mons. Dessaignes concludes, that when two bodies are presented to each other, a certain power is developed, under given circumstances, which is either attractive or repulsive in proportion to its intensity. It is excited by a degree of cold, which, when augmented, causes it to disappear. The same obtains in regard to heat. Mechanical pressure favours greatly the development of this power; and it manifests itself in the angular parts of the substances employed, in preference to any other. It often takes place only on the first approach of the two bodies; and must consequently be considered as the interruption of an equilibrium, which is soon after re-established.

Art. II. *Observations Météorologiques faites à l'Observatoire de Paris.*

Art. III. *Observations sur le Gaz hydrogène carboné appliqué à l'Eclairage.*

A translation of a Paper which has appeared in a former Number of our Journal.

Art. IV. *Le Cours de Géologie donné au Collège de France, par* J. C. De la Métherie.

Every one knows, that the author of the publication thus announced stands completely insulated in the midst of the republic of French savans. His notions, his various works, the manner of combating those of others—his style even, and composition, have given him an indelible character; a character, which in Europe has become synonymous with the name of the author. We will not deny that much service has been rendered to science, in general, by this indefatigable writer. But it often happens that we live too long for our reputation: it also sometimes occurs, that our reputation does not live long enough for us. Happy he who can say in time, "satis feci et non ultra progrediar."

The article before us is a review of a work written by the author of the work himself. It may be easily conjectured, that it is not an unfavourable one; and in fact, on looking over it, we find that Mons. De la Métherie has taken pains to inform us, not only that his *Cours de Géologie* is the best in the world, but that it is so, because he had already, and at different intervals, published such and such other works equally good and important to science.

Art. V. *Recherches sur la Nature de la Matière huileuse des Chimistes Hollandais, par MM.* Robiquet *et* Colin.

We have given the substance of this important Paper in our last Number. It well deserves to be wholly translated in some of our scientific journals.

Art. VI. *Observations pour servir à une Classification des Animaux, par M.* de Barbançois.

Our readers are acquainted with Delamarck's great work on philosophic zoology. The present writer approves the

general division into two classes adopted by that eminent naturalist, by which animals are considered and studied in a distinct manner, according as they possess or not that osseous arrangement, which has been denominated the vertebral column. But he objects to the subdivisions contained in that work. Those subdivisions are the following: 1. Mammifères. 2. Oiseaux. 3. Reptiles. 4. Poissons. 5. Mollusques. 6. Cirrhipèdes. 7. Annelides. 8. Crustacées. 9. Arachnides (insects without wings). 10. Insects (having wings). 11. Vers. 12. Radiaires. 13. Polypes. 14. Infusoires.

To adopt these subdivisions, the present writer thinks some alterations necessary. Man, he thinks, ought to be classed separately from mammiferous animals, from certain differences, derived from the anatomical structure, the apparent characters, and intellectual powers. The latter circumstance alone would suffice for the establishment of a *Règne moral*. Again; the reptiles he would have subdivided into two classes—the one comprehending the *scaly*, the other the *viscous* reptiles. As for the molluscæ, Mons. Barbançois is of the same opinion as Mons. Cuvier, who in a late Memoir read before the Institute, on the anatomy and structure of the sæpia, proposes to separate this order from the molluscæ, and to form a new class called *céphalopodes*. The *cirrhipédes* and the *annelides* ought to form but one class. Besides these variations, the author mentions several others, which it would be out of place here to transcribe. He gives several and some good reasons for the alterations proposed; and in general treats his subject as a man of sense. We shall, therefore, not scruple to give the following table presenting a summary view of his ideas on this interesting subject.

This is the second *projet de classification* which we lay before our readers since the commencement of our analytical labours. The first to which we alluded in our analysis of the *Bulletin de la Société Philomathique*, had all the characteristics of genius and of haste—haste, which was attributed to a fear, apparently groundless; since it is not to be presumed, that any *great* naturalist, however hostile his feelings may be, and however reasonable those feelings, would have availed himself of another person's researches in an unfair manner, and to the

exclusive advancement of his own reputation. We, however, recommend the present article in the original to the attention of all those who dedicate themselves to the study of the most perfect productions of nature.

Tableau de la Classification proposée.

			Degrès.	*Classes.*	*Sous-Class.*
Les Animaux divisés en	Vertebrés	à sang chaud	9me	Hommes	intelligens bornés
			8me.	Mammifères	terrestres marins
				Oiseaux	jambes gar. de pl. jambes dénu. de pl.
		à sang froid	7me	Reptiles écailleux	avec pattes sans pattes
				Reptiles visqueux	avec queue sans queue
				Poissons	osseux cartilagineux
	Invertebrés	à système nerveux visible	6me	Cephalopodes	avec sac avec coquille
				Mollusques	cephalés acephalés
			5me	Annelides	nus couverts
				Crustacés	entomostracés malacostracés
			4me	Arachnides	antennistes palpistes
				Insects à métamorp.	broyeurs suceurs
		à système nerveux invisible	3me	Vers interieurs	intestinaux viscéraux
				Radiaires	échinodermes malacodermes
			2me	Polypes	libres aglomérés
			1me	Infusoires	appendiculés lisses

AUGUST.

Art. I. *Mémoire sur les Propriétés optiques de Muriate de Soude, &c. par* D. Brewster.

Translated from the Philosophical Transactions of the Royal Society of Edinburgh.

Art. II. *Des Méthodes classiques et naturelles, appliquées à la Géographie Physique, par M.* Toulozan de Saint-Martin.

Mons. Toulozan is not only a writer of memoirs on *Géographie physique*, but the historiographer of nature. Our readers may perhaps recollect a work, in three thick volumes, announced in our list of foreign publications, contained in the last Number, to which this gentleman's name was affixed, *plus* that of a friend, a Mons. Gavotz. The present essay, however, is the sole—the unassisted effort of Mons. Toulozan himself; and the second, which he makes in favour of "a vigorous system of *Physical Geography*, now proposed* for the first time, this science never having had a system before." For this purpose, the author begins by borrowing a little from geology; and after having observed, that the opinions respecting the formation of primitive rocks were various, but that in regard to the secondary formations, it was agreed to consider them as the precipitate of substances previously held in solution, he comes to the very natural conclusion, that "the primitive are different from the secondary formations." This is so very clear and ingenious, that we shall not lose any time in explaining it. Unluckily for the author, not all the other conclusions, to be found in his paper, are equally convincing or intelligible. Thus, we have in vain read over, twice, the passages immediately preceding the sweeping paragraph, "*Après avoir ainsi réfuté l'opinion des Neptuniens,*" in order to discover the refuting arguments. Our researches have been unsuccessful; these arguments did not present themselves with that ease and evidenee with which we had perceived the *difference* between the primitive and the secondary rocks. The same might be said of Monsieur Toulozan's *aérifère* formation, (transition rocks,) on which a good deal of his system is

founded. But, in thus becoming the advocate of *air*, for its share in the great convulsions experienced by our globe, the author's immediate aim becomes evident, or, at least, we fancy it so. Tired with the *disputes éternelles* between the partizans of *water*, and the supporters of *fire*, Mons. Toulozan, with the most benevolent intention, "*a voulu y souffler dessus.*"

The practical parts of M. Toulozan's Mémoire are not subject to the same exceptions. We recommend his geographic divisions to our readers, who will be glad to learn that a large map of the *physical globe*, in which all the regions of the earth are designated under new names, will appear at the conclusion of the present essays.

Art. III. *De l'Etat actuel de la Chimie. Par* J. C. De la Métherie.

The author asserts, that chemical theories have taken such a turn, that the most eminent professors of chemistry in France, even the youngest of them, are not *à la hauteur* of the new doctrine. How can we believe this, when we daily read of, and witness, the great progress which the numerous eminent men who cultivate chemistry in France, make in that science? We must, therefore, suspect, that in making such an assertion, Mons. De la Métherie was either ignorant of what was going on in his own country, and under his own eyes; or that, following the example of many others, he wished to raise the reputation of the *ancients* on the ruins of that of the *moderns*, particularly of his own countrymen.

In this short and emphatic epitome of the actual state of chemical knowledge, the author complains bitterly, that his labours have been neglected, that his works have been pillaged, and that no mention of either has been made by the persons who had made free with both. He more particularly insists on the circumstance of his having asserted, before any body else, that there existed some acids without oxygen. We will be more just towards him—we will acknowledge to have read his various works. But how can we believe him to be serious in his claim of priority in this respect, when, of the few acids now ascertained to be without oxygen, two onl

existed at the time of his chemical speculations; one of which, (the sulphuretted hydrogen,) was scarcely considered as an acid, and the composition of the other, (the muriatic acid,) was not yet properly understood; while the remaining ones have been but recently discovered? After all, the most considerable part of this Memoir is a reprint of Mons. Ampère's paper on a new classification of simple substances, to which we alluded in our last Number.

Art. IV. *Mémoire sur les Substances minérales dites* en Masse *qui entrent dans la Composition des Roches Volcaniques de tous les Ages. Par* L. Cordier.

This is altogether an important paper; but not of a nature to be reduced into a small compass; being, as the subject required it, of a great length. It was read before the Institute more than a year ago, and the mere substance of it was then given to the public, if we mistake not, through some of the French journals. It now appears whole, and may be considered as adding a good deal to our already abundant stock of geognostic information. In the course of some experiments made to illustrate his theory, the author had an opportunity to observe the degree of heat at which fusion takes place, in the several mineral productions, generally considered as volcanic. In these essays, the temperature was ascertained by means of Wedgewood's pyrometer. The results were the following.—

Amphybole, (black, brown, blackish-green enamel), 50° 57′ to 71°.

Feldspar, (white, or yellowish-white glass,) 71° to 94°.

Pyroxene, (bottle-green, or yellowish-green glass,) 101° to 141°.

Iron Sand, *(fer titané,)* (black tarnished enamel,) 143° to 161°.

Oligistic Iron, (black and tarnished enamel,) 189° to 204°.

Mica, (a blackish-brown glass,) 183° to 236°.

Amphygene, (white glass,) 283° to 378°.

Peridot, (a yellowish-white, and a greenish-black enamel,) 472° to 756°.

SEPTEMBER.

Art. I. *Suite des Méthodes classiques et naturelles, &c. Par Mons.* Toulozan.

We must revert to what we said above, on the subject of this gentleman's Memoir.

Art. II. *Observation sur les Avantages du* Datisca Cannabina *dans l'Art de la Teinture. Par M.* Braconnot.

The *Datisca,* bearing a flower of a rich yellow colour, is cultivated in our English gardens, under the name of bastard hemp, and, according to our present author, yields a magnificent colour, not inferior to that furnished by any other plant now employed in the art of dyeing. Mons. Braconnot first gives a general botanical description of the plant, and next details the trials made with a decoction of it, by means of several re-agents. The mode of extracting the colouring matter in question, is the following. To the decoction of the plant, add a solution of acetate of lead—a precipitate will be formed, which is composed of a vegetable acid, and a gummous substance. Decant the liquid, saturate with potash, and again add acetate of lead—the liquor becomes colourless, and a precipitate is formed of a most beautiful yellow colour, not in the least altered when it is dried and pulverized. Wash the precipitate, and decompose it by means of sulphuric acid—the colouring matter will then be easily separated. When dry, it is transparent like gum, insoluble in alcohol, but perfectly soluble in water. The latter solution is not in the least altered by acetate of lead. Nitrate of mercury occasions a precipitate—sulphate of iron gives it a deep brownish colour—alum a more vivid and intense yellow cast; while the acids in general diminish the intensity of the colour. It may be easily applied to linen, silk, and cotton, but more so to wool, by following the customary processes of art.

Mons. Braconnot's experiments were made on the female flowers of the Datisca, none of the male being at his disposal. He afterwards enters into some details respecting the cultivation

of this plant, and concludes with recommending a trial of it on a large scale.

In a note affixed to this paper, the author mentions, that a solution in water of the extract of datisca, in which aluminated wool had been boiled, gave to the latter a very brilliant yellow colour.

While he was endeavouring to separate the colouring matter from the plant in question, Mons. Braconnot mentions having observed a new substance or principle, which he considers as peculiar to vegetables, and of which he gives a superficial account.

ART. III. *Observations météorologiques faites à l'Observatoire de Paris, par M.* Bouvard.

ART. IV. *Mémoire rélatif à l'Influence de la Température et des Pressions mécaniques sur l'Intensité électrique des Métaux et sur le Changement de la Nature de leur Electricité, par* J. Ph. Dessaignes.

However disposed we might be to look upon this gentleman's labours and researches with deference, there is a limit to which this present part of our Journal must necessarily extend, and which precludes us from giving an extract of the above Memoir, forming a supplement to the one by the same author, analysed in our last Number. The length and the importance of the paper, besides, preclude all kind of analysis in the present instance.

ART. V. *Supplément au Mémoire sur la Réduction des Degrès du Thermomètre de Mercure en Degrès de Chaleur réelle, par* Honoré Flaugergues.

The title of this paper alone, will suffice to shew that we could not give an abstract of it without having first noticed the former memoirs by the same author, to which it serves as a supplement, and to which it is referred, being contained in one of the anterior numbers of the *Journal de Physique.*

ART. VI. *Mémoire sur la Communication de la Structure des Cristaux doués de la double Réfraction, &c. par M.* Brewster.

Extracted from the Philosophical Transactions of the Royal Society of London.

Art. VII. *Des Taches du Soleil.*

This is an extract of Mons. Pictet's article, for which see our account of it above.

OCTOBER.

Art. I. *Suite des Méthodes classiques et naturelles, &c. &c. par M.* Toulozan.

To those who adhere tenaciously to the old prejudices of our schools, it will occasion some amazement to read, in the present continuation of M. Toulozan's second Memoir on *Géographie physique,* that Africa is the *fifth* part of the globe, and that there is a *sixth* part besides, and for aught we know, a seventh, and so on to a dozen. Yet so it is; and we think that the author makes out his case pretty clearly.

We also learn from this continuation of the *second* Memoir, that a *third* will soon appear, which is to be followed by a *fourth,* intended to throw out some useful hints for a new geographic nomenclature, which last work will certainly be laid before the public under the title of *Systema Naturæ, Pars Geographica,* illustrated, as we had occasion to mention before, by a general map of the physical world.

Art. II. *Observations météorologiques faites à l'Observatoire de Paris, par M.* Bouvard.

Art. III. *Prodrome d'une nouvelle Distribution systématique du Règne animal, par M.* H. de Blainville.

We have already noticed this same paper in our last number; and we are rather inclined to protest against this unnecessary multiplication of copies of the same memoir, in two or three different periodical publications, by which useless repetition a delay must be occasioned in the insertion of other valuable matter.

Art. IV. *Mémoire sur la Possibilité de faire vivre des Mollusques fluviatiles dans les Eaux salées et des Mollusques marins dans les Eaux douces, considérée sous le Rapport de la Géologie, par* F. S. Beudant.

For an account of this important paper, see the analysis of the *Annales de Chimie* for May, given in our last Number.

Art. V. *Suite du Mémoire sur les Substances minérales dites* en Masse, *&c. &c. par M.* Cordier.

See what we have said of this Memoir a little above. The present continuation contains a comparison of the mineral substances considered as non-volcanic, such as *Petrosilex, Trap,* and *Cornean rock,* with the lithoid paste of the currents of lavas of all ages. And an examination of the indetermined substances composing the volcanic scoriæ, and the vitreous lavas likewise of all ages.

Annales de Chimie et de Physique, par MM. Gay-Lussac *et* Arago.

JULY.

Art. I. *Suite du Mémoire sur la Composition des Acides phosphoriques et phosphoreux et sur leur Combinaisons avec les Bases salifiables, par* J. Berzelius.

Our readers are already acquainted with the importance and the object of this Memoir, without our detaining them further upon it.

Art. II. *Récherches sur les Lois de Dilatation des Solides, des Liquides, et des Fluides élastiques, et sur la Mesure exacte des Températures, par MM.* Dulong *et* Petit.

The public has been made acquainted with the substance of this highly interesting memoir, drawn up in a masterly manner, through the medium of an English scientific journal, some time ago; it having been read before the Institute in the month of May, 1815.

Art. III. *Mémoire sur quelques Expériences tendantes à déterminer, par la Coupellation et le Départ seulement, le Titre exact d'un Lingot contenant de l'Or, de Platine, de l'Argent, et du Cuivre, par M. Chaudet,* Assayer at the Mint.

It appears, from the author's statements, that there circulate in the trade, lingots of a quadruple alloy of gold, silver, copper, and platinum, in which the existence of the latter, either from ignorance or malice, is never acknowledged by the persons presenting them for sale. When platinum is present in a large proportion, the directions given by M. Vauquelin,

for detecting it, have hitherto enabled the common assayers to ascertain its existence; but never so accurately as to determine the precise quantity, and consequently the intrinsic value of the alloy under consideration. The continual embarrassments produced by this incertitude, induced M. Chaudet to investigate and study the point, which, notwithstanding D'Arcet's memoir on the alloys of silver and platinum, published in 1807, left a considerable chasm in the code of instructions for the assayer. Of course we cannot now be expected to enter into the details of all the experiments (ten in number) made by M. Chaudet, with a view of ascertaining the standard worth of the lingots in question, by the determination of the quantity of platina they might contain. This would extend too far for the limits of this part of our Journal. Suffice it to mention, that the author, after the account of his experiments, gives the description of his *modus operandi,* which seems quite simple and effective, for assaying the said alloys, and likewise his method for refining the lingots composed of gold, silver, copper, and platinum. This latter method consists, first, in fusing and granulating the alloy, by throwing it into water. Dissolve the metals in nitro-muriatic acid in capsules of porcelain, over a sand-bath. By this operation the silver is converted into a muriate, which being insoluble is easily separated by washing. When separated, it may easily be reduced by lime and charcoal, or carbonate of soda. Into the liquids containing a solution of copper, gold, and platinum, pour (after, however, having evaporated them to dryness and re-dissolved the mass in water) a solution of muriate of ammonia. This will precipitate the platinum under the form of a triple muriate, which may be obtained by decantation, washed, dried, and reduced by a gentle heat only. The solution of gold is next precipitated by the proto-sulphate of iron, in the metallic state, filtred, washed, and collected. And as for the copper, it may be obtained, likewise in the metallic state, by means of metallic iron.

ART. IV. *Sur quelques Phénomènes relatifs au Mode de Solution des Corps dans les Liquides et sur leur Application aux Loix de la Cristallisation, par* J. F. Daniell.

Taken from the first Number of the Journal of Science.

ART. V. *Note sur les Gaz intestinaux de l'Homme sain, par M.* Majendie.

We have already given the substance of this memoir in our preceding Number, in the account of the proceedings of the Royal Institute of France.*

ART. VI. *Expériences sur le Gaz hydrogène phosphoré, par* M. T. Thomson.

Translated from the Annals of Philosophy for August, 1816.

ART. VII. *Extrait des Seances de l'Académie des Sciences for July,*

ART. VIII. *Observations sur quelques Combinaisons de l'Azote avec l'Oxygène, par M.* Dulong.

"Chemistry," says the author, "exhibits combinations so difficult to isolate, and the production of which is accompanied by circumstances so complicated, that the most expert and accurate observers obtain a knowledge of their properties only after long efforts and successive labouring, in which, before attaining the truth, they, in a manner, expunge all kinds of existing errors." We had given in our last Number, a simple abstract of the paper now before us, as it had been read at the Royal Institute in the month of September, (see our account of the proceedings of the Academy for that month) and we should now have presented our readers with a more circumstantial detail of it, but that we perceive a complete translation has just been inserted in one of our contemporary publications, to which we must refer them.

ART. IX. *Météorological Observations* for July.

AUGUST.

ART. I. A Continuation of the Memoir of Berzelius on *the Composition of phosphoric and phosphorous Acids, and their combination. with different bases.*

ART. II. *Récherches chimiques sur les Corps gras et particulièrement sur leurs Combinaisons avec les Alcalis, 6me. Mem. par Mons.* Chevreul.

We had led our readers to expect this publication, by what

we had occasion to say upon it in our last Number. Mons. Chevreul, in the present memoir, after having recalled the subject of the former five papers forming part of his series of researches on the *Corps gras*, passes to the examination of the *human* fat, as well as of that of *mutton*, *beef*, *jaguar*, and *goose*. In a seventh memoir, not yet published, the Author proposes to study the oil of *Delphinus globiceps*, and the *fish oil* of commerce, and in an eighth, *butter* and *buttiric acid*. The present memoir presents us with the several properties which may be discovered in the fat substances above enumerated, without decomposing them, such as their colour, their fluidity at different temperatures, their smell, and their solubility in alcohol. Next we have the changes produced by potash on these substances, with an examination of the soaps resulting from a combination with it. The *Margaric* and the *Oleic* acids obtained from these soaps are afterwards compared to similar acids formed by means of the fat of pork. And in further detailing the analysis of the fat substances, forming the subject of the present memoir, by means of alcohol, we are presented with an account of the *Stearine* and *Elaïne*, separated from the soaps in question during that operation.

Art. III. and Art. IV. are taken from the Annals of Philosophy;—they relate to the late Mr. Howard's mode of refining sugar, and to M. Donavan's memoir relative to the impurities of hydrogene as obtained by the ordinary processes.

Art. V. *Rélation de la Découverte d'une Masse de Fer natif dans le Bresil, &c.*

This is the paper of Mr. Mornay, with notes and experiments by Doctor Wollaston.

Art. VI. *Observations physiques et météorologiques faites dans les Carpathes, par* M. Wahlenberg.

M. Wahlenberg, a Swedish botanist of much eminence, is the Humboldt of Europe with respect to the geography of plants. In the space of five years he has published no less than three esteemed works on this subject; and he has done

with regard to the mountains of our Continent, what the latter illustrious naturalist did respecting the Andes of South America. The present memoir gives an account of the Carpathian Mountains in Hungary, and is taken from the *Flora Carpathorum* published by the Author. The plains of Hungary and Transylvania are the most extensive in Europe. The mean height of the water of the Danube near Vienna is only 135. metres (442,5 feet) above the level of the sea. From Vienna to Presbourg, the river has an inclination of about 35.4 metres, (116 feet) and from Presbourg to Pesth 30.9 metres (103 feet,) But to give a more accurate idea of the inclination of the Danube, it will be sufficient to recollect the comparative heights of Ratisbon, Lintz, Vienna, Presbourg, Raab, and Pesth; which are 359 metres; 224 m.; 134 m.; 117 m.; 82 m.; 70 m.; The mean elevation of the immense plains of Hungary, distant 100 leagues from the coasts, is 68 metres; (225 feet) that is 468 metres less than the plains of Bavaria, the rivers of which flow likewise towards the Danube. This depression of the land in the east part of Europe is most remarkable in Hungary, Poland, and the interior of Russia. The plains of Pesth extend themselves to the foot of the Scépusian Carpathian mountains, and by their reverberation greatly contribute to give to these mountains, placed in a latitude of 49° 10′, a vegetative force equal to that of the Pyrenees and the Piedmontese Alps.

The Author next proceeds to detail his observations on the temperature and the salubrity of the air, made in various parts of the Carpathian mountains—and likewise the internal temperature of the earth at different places. These series of observations serve to establish a parallel between the two, as applied to plains, and elevated grounds in general.

ART. VII. *Sur des Eruptions volcaniques de l'Ile de Java et les Iles voisines.*

This is an extract from a paper inserted in No. II. of our Journal, with some additions by the translator.

ART. VIII.

Extract from the Philosophical Transactions, of Dr. Wollaston's Memoir on the property of diamond in cutting glass.

Art. IX. *Extract from Foreign and Domestic Journals.*

(See our own extracts on the same subject.)

Art. X. *Note sur la Pompe à vapeur, par M.* Gay Lussac.

This note contains an ingenious suggestion to the constructors of steam engines, for obtaining water at an elevated temperature, in those machines, without injuring their effect, and with economy. The author proposes his method for procuring this advantage, with diffidence, and without being positive as to its novelty, and ultimate good effect.

His method, in a few words, consists in having two, instead of one condenser only. The one destined to begin the condensation of vapour, and to supply the hot water; while the other completes the operation. Their reciprocal play must be successive; and in conveniently regulating the quantity of water injected into each condenser, a temperature of between 25 and 100 degrees (centigrade) might easily be obtained.

Art. XI. *Analysis of certain Minerals by* Gahn *and* Berzelius, *from the Swedish.*

Something of this kind has been given by Doctor Thomson in his Annals of Philosophy for September last.

Art. XII. *Proceedings of the Royal Academy of Sciences during September.*

(See our last Number.)

Art. XIII. and XIV. are from the Annals of Philosophy, and the Journal of Science—containing an account of Dr. Clarke's experiments,—and a description of a Lake of Soda in South America, by M. Palacio Faxar.

Art. XV. *Meteorological Observations for* August.

SEPTEMBER.

This Number is but just published, (December) and in importance is equal to any other since the new Series has begun under the sole management of the present very assiduous and

indefatigable Editors. Indeed a very great improvement in the Journal, altogether, has taken place under its present form; and we must hope, for the sake of science and scientific men, that no untimely interference of Government, or faint-heartedness of booksellers and coadjutors, will check its progress and circulation.

ART. I. *Expériences rélatives à la Fabrication des Savons durs, par M.* Colin.

After a short review of the researches of Pelletier, D'Arcet, and Le Lievre on the fabrication of soap, and of the more recent and important labours of Chevreul, and Braconnot, the Author gives a detailed account of twenty-four experiments made by himself, and directed to the same point—but chiefly intended to rectify certain errors committed by his predecessors, on saponification; and to illustrate certain obscure facts, at the same time that he establishes some more general and accurate principles on the subject. In these experiments M. Colin employed different oils, and various alcaline preparations, and ultimately tried the action of common salt on soaps. On the results he has obtained, the author makes several interesting observations, all of which he details with accuracy. Amongst them we shall only notice the most striking. M. Colin thinks that he has ascertained, 1st. that the simultaneous action of air and aqueous vapour on oils, destroys their smell, renders them colourless, disposes them to saponification, and above all, gives rise to the remarkable phenomenon of a separation taking place between a highly saponifiable part, and another which is so in an inferior degree. But this separation demands either a treatment by sulphuric acid, or a lowering of the temperature; 2d. that the liquid part of oils may be obtained by a well managed saponification; 3d. that water is absolutely necessary in the formation of soap; 4th. that common salt has this advantage over the soda of commerce, that it will harden to any degree the soap, in the fabrication of which it has been employed; 5th. that in augmenting the quantity of alcali, an obstacle is raised to the whiteness of the soap; 6th. that lime is a most important

ingredient for the fabrication of soap; 7th. that salts of soda decompose soaps having other bases; 8th. that solid, and sufficiently hard soaps for the purpose of washing, may be obtained with every kind of oil; and lastly, that the best and the finest soaps, and the most difficultly altered, are those which have been made with oils not previously submitted to the action of any other ponderable body.

ART. II. *Supplément pour l'Eclaircissement de plusieurs Objets dans la Dissertation de Mons. Berzelius.*

This supplement contains several other analyses of minerals by the above mentioned eminent chemist. In a first article the gadolinite of Finbo and Broddbo are analysed; they do not seem to differ much, as the silica, and yttria are in the same proportion in both, namely, 25.80 for the silica and 45+ for the yttria. The remainder is made up with 16+ protoxide of cerium and 10 + protoxide of iron. M. Berzelius never having been able to obtain the yttria perfectly white, suspects that the white precipitate obtained by ammonia in the analyses of Klaproth and Vauquelin was not pure yttria, but a sulphate of yttria; but the editors of the "Annales" very justly observe, that the latter chemist having obtained his precipitate from a nitric solution, Berzelius's supposition cannot hold good with regard to it. The reason given for this supposition by the author, is that he himself has never been able to obtain the yttria completely free from the oxide of cerium; and that the only method which succeeded with him, was a decomposition of the triple sulphate of potash and yttria mixed with that of cerium; in washing the precipitate and dissolving it in either nitric or muriatic acid, and precipitating the solution by a sub-carbonate of ammonia in excess in order to redissolve the yttria. After separating the precipitate, which contains much oxide of cerium, the solution is heated, and by the disengagement of the carbonate of ammonia, the yttria is separated almost white. The second Article contains an analysis of the hitherto known Fluosiliciates, particularly the topaz, the *pyrophysalithe*, and the pycnite.

Art. III. *Lettre de* M. E. Clarke, *Professeur de Minéralogie, &c. au Rédacteur du Journal de l'Institution Royale. &c. &c.*

This is a translation, *in toto*, of Dr. Clarke's Letter to Mr. Brande, giving an account of his experiments on metallic oxides, and other mineral substances. The subject seems to have attracted a considerable attention on the continent.

Art. IV. *Mémoire sur les Propriétés nutritives des Substances qui ne contiennent pas d'Azote. Par* M. F. Majendie.

We have given the spirit and substance, and that is all we could do, of this paper, in our last Number, when speaking of the proceedings of the Royal Academy of Sciences, before which it was read. M. Majendie, however, now objects to our note to his paper; and his objections are detailed, at full length, in the article of the "Annales" we are now reviewing. The fact is, that we consider the whole information contained in his paper, as extremely futile, and leading to no possible, practical, or useful result whatever. Much less are we inclined to view the scanty, insulated facts, founded on ill-devised experiments, as sufficient to authorise him to draw any, even the most superficial, inference, which, if passed unnoticed by professional men, might induce him to adopt it, in his next volume of Physiology, as the basis of some incorrect generalization, of which he has, now and then, given us some instances. But we are not fond of declaiming, without supporting our assertions with the semblance, at least, of reason. Why undertake the experiments on the "mouvement nutritif" on carnivorous, rather than herbivorous animals? What practical result, in the least useful, can be derived from *suddenly* and *completely* changing the usual diet of a carnivorous animal? and submitting it to live on sugar, butter, or gum!! What can we possibly conclude from the subsequent extinction of those poor animals, but that they were starved to death "novo modo?" And yet Professor Majendie affects to be astonished at it; or rather, attributes it to the mere want of azote in the substances given! We really wish him too well to be anxious to see a repetition of his experiments made upon

himself; but if, from the above conclusion, we are to argue, that the presence of azote would have saved the animals from starvation, we advise him to prosecute his researches—but to do so upon graminivorous animals; and above all, to try the effect of a gradual, instead of a sudden and violent change in their diet

But M. Majendie may object to us, that his intention was merely to prove, that the presence of azote in animals, is due to the aliments containing that principle.* Granted for a moment. How much would the knowledge of such a fact advance us in the science of the "*mouvement nutritif*," more than the experiments on the coloration of bones by madder, or any other similar experiments, have done—namely, very little? We ought, therefore, to be very careful, when the itch of experiment assails us, how we suffer ourselves to be pushed on by fanciful theories, that have "neither habitation nor a name."

One word more, and we have done. M. Majendie, it seems, has been at the trouble of rummaging amongst the English Medical Journals, to find, that Dr. Stark had submitted himself to the use of sugar for a month; and he adds, on the authority of a nameless person, that the Doctor died in consequence of it. To this assertion, we answer by another: that we know him to have died from no such cause. But even had *he* fallen to victim to this sudden change of diet, what would his case prove in favour of the Professor's theory?

Art. V. *Rapport fait à l'Academie de Sciences le* 14 *Octobre* 1816, *sur un Mémoire de M.* Hachette, *rélatif à l'Ecoulement des Fluides par des Orifices en mince parois, et par des Ajutages cylindriques ou coniques.*

(See our account of the proceedings of the Academy of Sciences, in our last Number). Mons. Cauchy was the reporter, and the Commissioners, while approving the memoir

* M. Majendie seems to insinuate, that the affirmative obtains in this case, because, in examining the secretions and excretions of the starved animals, M. Chevreul and himself, could discover a trifling proportion only of azote; but why not analyse the muscular fibre of the animals after death?

generally, proposed several important problems for solution, to the author.

Art. VI. *Déscription d'un Thermomètre propre à indiquer des* Maxima *ou des* Minima *de Température. Par M.* G. Lussac.

This is an extremely ingenious devise, but one which, for want of a plate, we cannot well describe; and time is wanting for the execution of the necessary figures. The apparatus is chiefly calculated for ascertaining the temperature of lakes and seas, taken at verv great depths.

Art. VII. *Sur la Longueur des Pendules à Secondes, Par M.* Laplace.

For an account of this note, see the proceedings of the Institute.

Art. VIII. *Extraits de Journaux, &c. Bibliothèque Universelle, Juillet* 1816.

We have already given, in a former part of this Number, a similar account of the Journals in question. But in the "Annales," we find something more interesting, in the shape of two notes to the *Bibliothèque Universelle*, respecting the "Spots in the Sun." In the first note, there is a curious account relative to the temperature of the rain fallen in 1815, compared with that of the succeeding year, in Paris. In 1815, the mean temperature of the first ten months was = + 12°,0, (centig.) In 1816 = + 10°,5. In 1815, the quantity of rain collected during the first ten months, was = 36 cent. 77. In 1816, on the contrary, = 43 c. 47. The difference, therefore, in old measures, corresponded to two inches, five lines, and seven tenths. The comparison goes on further, and, it is remarked, that in 1815, from January to October inclusive, there had been 127 days of rain: in 1816, *eight* days more, during the same space of time. In 1815, it rained twelve times in July: in 1816, the same month presented but *five* days without rain. The second note contains some reflections on the endeavours made by several astronomers, to shew the little connection existing between the spots lately observed in

the Sun, and the variations of temperature which we experience. The whole note is worthy of the masterly hand which has traced it; and we need not be prophets to guess whose hand it is. Let those who are too fond of, and too hasty in, generalizations, read this note, and profit by the advice there indirectly given by one, whose name is marching rapidly towards immortality.

Art. IX. *Observations des Redacteurs sur un Article du* Journal de l'Institution Royale de Londres.

We may now consider our Publication, as the French would call it, *comme un Journal bien établi.* We have attracted the attention, and merited the animadversions, of men justly esteemed for their talents, their discoveries, and their great proficiency in the cultivation of science. This circumstance must be particularly flattering to us; and the urbanity, with which the reflections of our opponents are conveyed to us, renders our lot exceedingly bearable, and our task of replying to them, not altogether difficult. Of course we cannot be expected to shew much *esprit* in what we shall have to say. We make no profession of it: *ce n'est pas chez* nous, *qu'on en trouve*; so that we must content ourselves with replying in homely phrases. We only wish that this Article had been entirely our property, as its title would seem to indicate: that is, we wish we had been made responsible for our own faults only; and that our supposed offence had been the only subject of the present observations of the Editors — and this for the good reason, that we are not fond of meddling with the affairs of others, when we have our own to mind. If, indeed, we have brought forward, in our last Number, while speaking of the *Piles seches Voltaiques,* (page 161,) a charge against the French in general, (and not against the Editors of the "Annales" in particular, as they appear to understand it, from not paying sufficient attention to the language,) of an over anxiety in putting forth a claim of priority in favour of their own countrymen, in cases of new discoveries or inventions; it does not necessarily follow that we are to answer for the observations of an English critic, who may have taken into

his head, eight or ten years ago, to find fault with the French mathematicians, for having adopted the trigonometrical notation of large A's and small b's, from an English writer without acknowledging it.* A similar feeling of esteem for the Editors of the *Annales*, to that expressed by them for us, has induced us to notice their answer to our observations, which we in general shall abstain from, lest we should involve ourselves in controversy, seldom or never productive of any useful results to science.

Our assertion, that Voltaic piles made with *colle*, which gradually loses *son humidité* cannot be considered as *dry* piles, is granted to us, and thus far we were right. But we forgot

* That our readers may understand the above allusion, it will be necessary to say, that *MM. les Redacteurs* in order to retort the accusation we brought against the French in general, of an over anxiety in claiming the priority of discoveries in favour of their countrymen —have been at the trouble of finding out a *reclamation* of this kind, made sometime ago by a critic in the Quarterly Review, on an insignificant subject, which *reclamation* they have translated and given in by the present Number, accompanied the following observations.

" M. Le Redacteur insinue que nous ne saurions écrire un article *quelconque* (a mistake for want of a sufficient knowledge of the language) sans y placer une reclamation en faveur des savans Français : ainsi, pour qu'il nous pardonne celle que nous venons de lui adresser, nous allons extraire textuellement du tome V. du Quarterly Review, page 344, un passage qui lui montrera que quelques-uns de ses compatriotes ne sont pas en reste à cet égard, puisqu'il reclament ce que personne en France *n'a, n'a eu, ni aura* l'envie de leur contester (they might have added *ainsi soit-il.*)

Here is the passage in question. " The mode of designating the angles of triangles, by the capital letters A, B, C, and their opposite respective sides by the same letters, under another form, a, b, c, was invented by an Englishman, and published by Gardiner, in the introduction to his Logarithmical Tables, about sixty years ago. These tables were in much general use on the Continent, and a new edition of them was published at Avignon in 1770. The French mathematicians soon perceived the advantages of this improvement, and with their usual generosity, adopted, it, making us, at the same time, believe, that it was due to them." (We translate from the French quotation).

those constructed by the said Messrs. Hachette and Desormes, with *varnish*, which were described in a memoir read at the Institute in 1803; but never published until 1809; (the year in which De Luc published his invention, and we suspect some *months* afterwards) when they were mentioned in the *Programmes de Physique, par* M. Hachette. These piles the editors consider, as being *dry* enough to stand with those of De Luc and Zamboni, and consequently to bear away the palm of priority from the two latter. But we deny the conclusion *in toto*, and put it fairly to the editors and to our readers, and those of the *Annales de Chimie*, in general, to say whether Messrs. Hachette and Desormes' piles are in the least similar to those of De Luc and Zamboni, either in their principle, their construction, their nature, their application, or their effects. Can they, above all, be considered as like those of Zamboni, in the composition of which we have only zinc (with a little tin) and an oxide of manganese,* between which a disk of paper, previously dried in a hot oven, is interposed?

We shall always feel the greatest deference for all that foreign *Savans* do in behalf of science; and therefore have little apprehension as to the observations which may be made in Germany, on our mode of combating facts, by mere assertions. We, however, thank the editors for their kind concern for us; and while we beg them to point out in what part of the article in question, we have made any *assertion* devoid of *all foundation;* we shall also feel much obliged to them to explain to us in what the numerous papers written by MM. Heinrich, Schübler, and Schweiger (whom they accuse us of treating too severely) are in the least important or instructive, as far only, as they relate to the dry Voltaic piles of De Luc and Zamboni.

As to our own experiments on Zamboni's pile, on which MM. les Redacteurs have been so *pointed*, we should not have mentioned them in the article in question, had we not read in the "Annales" of the *impuissance* of the dry piles, *pour produire*

* By a letter received from Zamboni last year, we are informed that the oil or honey are no longer employed in the apparatus.

des effets chimiques; an assertion which we were simple enough to take *à la lettre*, and therefore contradicted it, by mentioning the result of our own experiments. We acknowledge the incomparable good luck which our French brethren have, of being continually before us, even in trifles, and therefore are not astonished that the editors should have immediately found out that our experiments, insignificant as they are, had been made before in France. Still we will venture, but with the greatest submission, to suggest to *MM. les Redacteurs*, that in the parallel they have made of our experiments with those previously executed by the French, they forgot some trifling difference, which may yet (unless a further ransacking of the whole collection of the French scientific journals should prove again *unlucky* for us) leave us a small chance of *originality*. We allude, 1. To our assertion, in *opposition* to what the French and Germans have said, that the dry pile can not be considered as a hygrometrical instrument. 2d. To the regularity of the oscillations of the pendulum, observed by us from the first moment in which it was put in motion, till it ceased to vibrate in consequence of the disappearance of the oxygene of the air; and 3dly and lastly, To the phenomenon we have remarked of the said pendulum being slowly attracted (at the distance of three inches) to the positive pole, the instant a proper supply of air was cautiously introduced into the apparatus, a phenomenon which being purely *electrical*, cannot be fairly compared with that of the decomposition of water recommencing under similar circumstances, as mentioned by the editors, and must therefore be considered as perfectly distinct, and recorded for the first time by us. Still we do not mean to attach much importance to these observations.

We shall never decline taking up the gauntlet which such eminent men as the editors of the Annales may choose to throw at us; persuaded, that defeated or conquerors, we shall alike derive much benefit from the contest. We shall always hope, however, to keep our temper, and above all, to avoid personality.

ART. X. *Extrait des Séances de l'Academie, mois de Septembre.*

ART. XI. *Observations sur la Combinaison des Métaux avec le Soufre, par M.* de Moutizon.

We shall insert in the next Number a translation of this short but interesting paper.

ART. XII. *Sur la Température de la Mer et des Animaux qui y vivent, et sur celle de l'Air.*

This is an extract from the second volume of Freycinet's Voyage, so often alluded to in our present Number, with the additional observation of Dr. Davy on the same subject, published in the last Number of this Journal.

*** We are sorry to be under the necessity of here breaking off our account of foreign journals, which will be resumed in the next Number. The importance of their contents renders us unwilling to abridge too much.

ART. XXII. Evans's *Account of Excursions beyond the Blue Mountains in New South Wales.*

IN the year 1813 and beginning of 1814, Mr. George William Evans, Deputy Surveyor of Lands at Sydney, for the first time explored a considerable extent of country to the westward of the Blue Mountains. The tract of land hitherto occupied by the colonists of N. S. Wales is very limited, extending along the eastern coast to the north and south of Port Jackson only 80 miles, and westward, about 40 miles to the foot of the chain of mountains in the interior, which form the western boundary: it is singular that in the twenty-five years, which the colony has been established no one of the settlement had been induced to explore the passage over these mountains. Two attempts were formerly made, one by Mr. Bass, and the other by Mr. Caley, both of which failed. The first passage over the most difficult and rugged part of these mountains was effected by Messrs. Blanland, Wentworth, and Lawson. The present Governor

Mac Quarrie, soon after his arrival at the colony, availing himself of the facilities afforded by the discoveries of these three gentlemen, determined to encourage the attempt to find a passage to the western country, and in Nov. 1813, Mr. Evans was entrusted with the accomplishment of this object. The result of this journey has been long before the public. The favourable account of this gentleman induced the governor to cause a road to be constructed for the passage and conveyance of cattle and provisions to the interior; this road, after great exertions and labour, was completed, under the directions of William Cox, Esq. and on the 25th of April 1815, the Governor and his suite commenced an excursion over the Blue Mountains by the new road. The early part of the journey was found to present fewer difficulties than were expected. At a distance, however, of about twenty miles the country changes, being rocky and mountainous, and extremely rugged. The views on the summit of the western mountains, are described as very beautiful, and the scenery of the glens and passes are very grand and romantic. Fifty six miles in the interior, two streams unite in a valley, forming a river, called by the Governor, Cox's river, which empties itself into the river Nepean, and it is conjectured from the nature of the country through which it passes that it must be one of the principal causes of the floods which have been occasionally felt on the banks of the Hawkesbury, into which the Nepean discharges itself. Westward of Cox's river the country becomes hilly, but is generally open forest land, and good pasturage: a range of lofty hills and narrow vallies alternately form the country from Cox's river to Fish river. A distance of 16 miles from thence to Sidmouth valley the country continues hilly, affording good pasturage; at the valley, the land is level and for the first time unincumbered with trees; the country is again hilly to Campbell's river (13 miles), when it exhibits an open and extensive view of rising grounds and fertile plains. Judging from the height of the banks, this river must be on some occasions of very considerable magnitude, but the great drought which had prevailed at the time of the Governor's excursion for the three preceding years, had reduced the river so that it then had the appearance of a chain of ponds; the soil on

its banks was very rich. Seven miles from the bridge over Campbell's river, Bathurst plains open to the view, presenting a rich tract of eleven miles in length, bounded by rising hills thinly wooded. The Mac Quarrie river, which is formed by the fountain of the Fish and Campbell rivers, takes a winding course through the plains. On the twelfth day the Governor arrived at these plains (140 miles distant from Sydney,) and remained a week, making excursions in the surroundiug country, and whilst there, fixed on a site for the erection of a town (Bathurst) at a future period. The excursions whilst at Bathurst did not exceed 22 miles in a S. W. direction. The country was found generally fertile and well adapted to the purposes of agriculture; within ten miles of Bathurst there are not less than 50,000 acres of land clear of timber, one half of which, at least, is excellent soil. The timber to the westward is inferior to that of the northern colony. Coal and lime-stone were discovered; game and fish abundant. The foregoing account of the Governor's excursion reached this country some time since; but the Governor, whilst at Bathurst, desirous to make further discoveries of the country to the west, instructed Mr. Evans to proceed, and pursue his discoveries as far westward as the means of carrying provisions and the nature of the country would permit. The result of this excursion by Mr. Evans has very lately reached this country; and the following is a brief account extracted from the

Journal of that Gentleman.

On the 13th of May, 1815, Mr. Evans commenced his tour of discovery, and on the 2d of June, finding his provisions would not enable him to proceed further, he began to retrace his course back to Bathurst, where he arrived on the 12th, having been absent thirty-one days. In the course of this tour he travelled over a vast number of rich and fertile vallies, with successions of hills well covered with good timber, chiefly the stringy bark and the pine, and the whole country abounding with ponds and gullies of fine water; he also fell in with a large river, which he conceives would become navigable for boats at the distance of a few days travelling along its banks:

from its course he conjectures that it must join its waters with those of the Mac Quarrie river; and little doubt, it is observed, *can be entertained, that their joint streams must form a navigable river of very considerable size.* At a distance of about sixty miles from Bathurst, Mr. Evans discovered a number of hills, the points of which ended in perpendicular heads, from thirty to forty feet high, of pure lime-stone of a misty gray colour.—At this place, and also throughout the general course of the journey, kangaroos, emues, ducks, &c. were seen in great numbers, and the new river, to which Mr. Evans gave the name of the *Lachlan,* abounds with fish. In the course of this tour, Mr. Evans also discovered a substance which he describes as possessing much of the sweetness and flavour of manna, but totally different in its appearance, being very white, and having a roundish irregular surface, not unlike the rough outside of confectioner's comfits, and of the size of the largest hail-stone. Where this substance was found most *plentiful, kangaroos were seen, in immense flocks, and wild fowl* equally abundant.

The natives appeared more numerous than at Bathurst; but so very wild, and apparently so much alarmed at the sight of white men, that he could not induce them to come near, or to hold any intercourse whatever with him.

At the termination of the tour, Mr. Evans saw a good level country, of a most interesting appearance, and a very rich soil; and conceives that there is no barrier to prevent the travelling farther westward to almost any extent that could be desired. He states that the distance travelled by him on this occasion, *was* 142 *measured out miles;* which, *with digressions to the southward, made the total distance* 155 *miles from Bathurst:*—He adds, at the same time, that having taken *a more direct line back to Bathurst than that by which he left it, he made the distance then only* 115 *miles,** and observes, that a

* The exact course taken by Mr. Evans is not very distinctly stated; plans, however, of the route, both of the Governor and Mr. Evans, have been forwarded to the office of the Secretary of the Colonial Department, which we hope at a future period we may be able to lay before our readers.

good road may be made all that length without any considerable difficulty, there not being more than three hills which may not be avoided.

From the entire tenor of Mr. Evans's narrative, it appears that the country over which he passed has even exceeded the country leading to and surrounding Bathurst, in richness, fertility, and all the other valuable objects for the sustenance of a numerous population. To the foregoing account, the Governor had added some particulars omitted in his own tour.

When he arrived at Bathurst, he found there three native men and six children, standing with a working party: they appeared much alarmed, particularly at the horses—but this soon ceased, and they became quite familiar. Frequently during the stay at Bathurst, small parties of men and boys came in. They were in appearance very like those of Sydney, though rather better looking and stronger made; some of them were blind of one eye, though not always on the same side.—Their language being altogether dissimilar to that of the natives of Sydney, it was impossible to learn whether their being thus blinded was the result of any established custom, or accidental.

These men were covered with skins of different animals, neatly sewed together, and wore the fur side inwards; on the outer, or skin side, they had curious devices wrought. They seemed to be perfectly harmless and inoffensive, and by no means warlike or savage, few of them having any weapons whatever with them, but merely a stone axe, which they use for cutting steps for themselves to climb up trees by, in pursuit of the little animals which they live upon.

These natives never brought any of their females with them on their visits to Bathurst.

Art. XXIII. *Proceedings of the Royal Society of London.*

On Thursday the 7th of November, the Members of the Royal Society resumed their sittings, after the long vacation.

A paper was communicated by Sir Everard Home, containing an account of the circulation of the blood in the Lumbricus

marinus, and of the difference between it and that of other molluscæ. The Lumbricus marinus has a circulation peculiar to itself, the centre of which is situated in the middle line of the belly, and though very small, must be regarded as the heart—it receives the blood from two separate auricles, one on each side of the back, and also from a vessel from the head. The blood passes from the heart into an artery descending to the tail, and vessels are sent off from it in pairs to the external gills. The branches going to the upper gills are contorted, those supplying the lower go to them in straight lines; the blood is thence received by a vein on the back of the animal, and by two veins on its sides, which swell into the auricles above mentioned. In the Lumbricus terrestris there is no centre of circulation. An artery runs along the belly, and a vein along the back, from which all the other vessels branch off, and these two great trunks communicate laterally by five pairs of reservoirs which receive the venous blood, and empty it into the artery. These, Sir Everard says, may be called auricles. The blood is aerated by vesicles communicating with the venal trunk. It is remarked that the Sepia having three hearts, has been supposed to bear no resemblance to other animals; but the author points out its analogy in regard to circulation, to the Terodo, the blood being brought to two auricles and thence passing through one ventricle.

The Paper concluded with a comparative view of the sanguiferous systems of the Teredo, the Sepia, the Lumbricus marinus, and the Lumbricus terrestris.

Thursday, November 14th, a paper was communicated on the Hirudo vulgaris, or leech of rivulets, by Dr. Johnstone. The author has adopted the specific name Vulgaris, instead of Octoculata employed by Linnæus, because the Hirudo tessulata has also eight eyes. This leech is hermaphrodite, and oviparous, its eggs being contained in a small capsule which the animal throws off, and from which the young make their escape at variable periods.

Thursday, Nov. 21st. Dr. Wilson Philip communicated a paper on the effects of Galvanism, in curing asthmatic dyspnœa. The plan proposed consists in applying to the sternum and

spine a piece* of tin foil, and connecting these pieces with a Galvanic battery of 8 to 16 four-inch plates, rendered active by muriatic acid. The benefit is immediate. In spasmodic asthma, Dr. Philip derived no advantage from this plan of treatment.

Nov. 30. The Society held the Anniversary Meeting, for the Election of Officers for the year ensuing, which were as follows:

PRESIDENT. The RIGHT HONOURABLE SIR JOSEPH BANKS, Bart. G. C. B.

SECRETARIES.*

William Thomas Brande, Esq. (in the room of Dr. Wollaston, who resigned.)

Taylor Combe, Esq.

FOREIGN SECRETARY. Thomas Young, M. D.

COUNCIL.

Rt. Hon. Sir Jos. Banks, Bart.	Samuel Lysons, Esq.
John Barrow, Esq.	Alexander MacLeay, Esq.
William Thos. Brande, Esq.	Alexander Marcet, M. D.
Samuel Goodenough, Lord Bishop of Carlisle.	George, Earl of Morton.
John George Children, Esq.	Colonel William Mudge
Taylor Combe, Esq.	William Hasledine Pepys, Esq.
John Wilson Croker, Esq.	John Pond, Esq.
Sir Humphry Davy, Knt.	Earl Spencer.
Sir Everard Home, Bart.	Sir John Thos. Stanley, Bart.
Charles König, Esq.	Dr. Wollaston.
	Dr. Young.

ART. XXIV. *Proceedings of the Royal Society of Edinburgh.*

November 17th. A Letter from Professor Playfair to James Jardine, Esq. Civil Engineer, was read. It contained an account of some appearances on the sides of the mountains in Switzerland, which Mr. Playfair considered as analogous to the parrallel roads of Glenroy in Scotland. These appearances were seen in

the Vallais near Brieg, and consisted of lines on the sides of the hills, extending for several miles, and nearly horizontal. They are generally marked with a more luxuriant vegetation, and often with the appearance of a road. There were often two of these lines, one at a considerable distance below the other, and in some instances three. Mr. P. found upon enquiry, that they were formed for the purposes of irrigation, and were a kind of aqueduct, by which the streams that descended over the face of the mountains are conveyed laterally to a great distance. Hence he supposes that the parallel roads of Glenroy may have had a similar origin, and this idea seems to be confirmed by the fact, that one of the roads in Glenroy sets off at the head of the valley from a marsh or spring, which forms one of the sources of the Roy.

At the same meeting, a communication from Dr. Brewster was read "on the effects of mechanical pressure in communicating double refraction to regularly crystallized bodies." When polarised light is transmitted along the axes of crystals, such as beryl, calcareous spar, and quartz, both the polarising force and the force of double refraction vanish, and their forces increase with the square of the line of the angle which the polarised ray forms with the axis. When the polarizing force is so weak as to produce tints within the limits of Newton's scale, Dr. B. found that the application of compressing and dilating forces was capable either of increasing or diminishing the polarising force, and the force of double refraction, according to the manner in which they are applied, and of communicating the same forces to the crystal, when the ray is exactly parallel to the axis. These experiments were made with calcareous spar and rock crystal. Dr. Brewster also found that the forces of double refraction and polarisation could be excited in minerals by the transmission of heat in the same manner as in plates of glass. The effect is, however, less marked on account of the rapidity with which heat is communicated through minerals.

Dec. 2d. A communication from Mr. Bald, Civil Engineer, was read. It contained an account of some experiments which he had made in Ayrshire, with the safety lamp of Sir Humphry Davy; the results proved, in a striking manner, the security which is derived from this valuable invention.

Dec. 16. A communication was read by Mr. Bonar, containing observations on the filiation of the various languages spoken in the eastern parts of India, and their affinity with the Sanscrit and Chinese; transmitted by Messrs. Carey, Marshman, and Ward, missionaries employed under the Baptist Society.

At the same meeting, a paper by Dr. Brewster was read, containing the results of a very extensive series of experiments on the action of regularly crystallised bodies upon light. From these experiments Dr. Brewster has been led to the determination of all the laws by which the phenomena are regulated, and has been enabled to compose formulæ by which the tints, and the direction of the axis of the particles of light, may in every case be calculated a priori. The law of double refraction investigated by La Place, and the laws of the polarising force deduced by M. Biot were shewn to be merely cases of laws of much greater extent and generality, being applicable only to two or three crystals, while those investigated by Dr. Brewster are applicable to the vast variety of crystallized bodies which exist in nature.

Art. XXV. *Miscellaneous Intelligence.*

Report on some Experiments made with compressed Oxygene and Hydrogene, in the Laboratory of the Royal Institution.

The results of the decomposition of the earths, stated to be obtained by Dr. Clarke of Cambridge, by the use of an improved blow pipe, were so important as to induce a desire to verify them in most persons. The experiments have frequently been made in this Institution, and were repeated a few days since in the presence of most of the distinguished chemists now in the metropolis, but always without success. The earths and their salts are fused, and the result is constantly the pure anhydrate, which appears as a hard stony mass, but never exposing a true metallic surface with a clean file, or effervescing with water or dilute acids. If impurities are present, there are different phenomena according to the nature of these impurities. When iron forceps are employed to hold the earth, a hard black slag is produced, which scratches glass,

and in some cases abrades the file, and is sometimes capable of exhibiting a polished surface approaching slightly towards plumbago, but no indications of a metal are obtained, and there is no liberation of gas, as might be expected, when it is thrown into water; for as Sir H. Davy has shewn in his researches on the nature of the earths, barium, when combined in very small quantities, even $\frac{1}{10}$th, with other metallic substance, as iron or mercury, causes, on being thrown into water, a copious evolution of gas.

A fine splinter of hematite was placed in the flame, and it instantly fused, but no decomposition took place; a crystal of oxide of tin was then exposed to it, and the heat was so intense as to sublime the substance, but it arose unaltered, no tin being reduced. This substance was remarkably infusible; and though the angles became rounded, it appeared to be rather from the volatilization of the oxide immediately from the solid state, than from a previous liquefaction of it.

It appears therefore that these substances, when treated per se, are not altered in their chemical nature, and that it is only the state of the body that is affected. When heated with charcoal or other combustibles, or even with other metals than those contained in them, a reduction takes place; but even all aids of this kind applied to the earths have as yet failed, in our laboratory, to effect their reduction.

It is scarcely possible to say what can be the cause of results so different as those obtained here and by Dr. Clarke at Cambridge. That the heat obtained was as great, may be judged from the fusion of corundum, rock crystal, pure alumine, &c. but it is probable that some impurities in the earths or supports used, have caused appearances on which the idea of decomposition has been founded. The effects of the instrument are certainly very great, but such as might be expected from the previous experiments made in America; thus the fusion of the earths and precious stones has been effected, and bodies formerly considered as fixed, volatilized, but no decided evidences have yet been offered of such extraordinary decompositions as those of the earths, and the experiments made in this place are all inimical to that conclusion. M. F.

Notice of some Experiments on Flame made by Sir H. Davy.

A series of experiments have lately been made on flame and inflammation, by Sir H. Davy, in the laboratory of the Royal Institution, and some that he had made in the country repeated, and they offer results of great interest in this part of chemical knowledge.

By rarefying explosive mixtures more or less by the air pump, it has been ascertained at what point they lose the power of inflaming by the electric spark. It appears that this differs with the various gases, some exploding in a rarer state than others, and the difference seems to depend on the heat required for the combustion of individual portions of the gas, and that given out by their combustion. Thus chlorine and hydrogene, which burn at a lower temperature than oxygene and hydrogene, and yet produce nearly as much heat, will bear a greater rarefaction before their combustibility is destroyed, because, as the heat produced by inflammation diminishes with the rarity of the mixture, the quantity requisite for the inflammation of contiguous portions of oxygene and hydrogene is sooner lost than when chlorine and hydrogene are used. This is proved still more decisively, by supplying by other means than the combustion of the gases the heat necessary for the continuance of inflammation, for it has been found that a mixture so rarefied as not to explode by the electric spark, did inflame when considerably heated. Sir H. Davy has also proved that the combustibility of all gaseous mixtures is increased by rarefaction by heat. These experiments are decidedly opposed, in their results, to those of M. Grotthuss, and overturn the theory of that gentleman.

Sir H. Davy has ascertained that the compression produced by flame, is not the cause of continuous explosion; for an explosive mixture of hydro-phosphoric gas and oxygene was condensed into one fourth of its original volume without inflaming, though a heat not greater than 240° is required for its combustion.*

The results obtained by diluting explosive mixtures with other gases, are likewise interesting. The power exerted by

elastic media in preventing the inflammation of such mixtures, seems, with the exception of the acid gases, to be as their densities and capacities for heat. These latter, because of their attraction for the water formed, are more efficacious in extinguishing flame than they otherwise would be. A result perfectly in harmony with the experiments by expansion, is, that those gases which require least heat for their combustion, bear the highest degree of dilution before their combustion is prevented. Details of these experiments, and the practical inferences to be drawn from them, we believe, will shortly be laid before the Royal Society. M. F.

On the Wire-gauze Safe-lamps.

The wire-gauze safe-lamp has been now in general use in almost all the northern mines infested with fire-damp, for eight months, without a single failure, not a square inch of skin, according to an expression of the gentleman most extensively concerned in the collieries, has been lost during that time in the parts of the mines where they have been used.

Sir H. Davy has lately had some lamps made of thick twilled iron gauze, which contains 16 wires in warp, and about 30 in weft. This material, though nearly as permeable to light and air, as the ordinary gauze, is far stronger, and does not, whilst in use, heat so much. A single lamp constructed of it never became red hot in the most explosive atmospheres to which it could be exposed, and no means that could be devised, inflamed jets and blowers thrown upon it on the outside.

The web is made after Sir H. Davy's directions by Bayliff and Rigge, wire-workers, Kendal, and lamps are now constructed of the improved material by Mr. Newman, Lisle-street. Should no objections arise in the collieries to its use, there is no doubt that as the old gauze in lamps is worn out, it will be replaced by the twilled gauze. With this material the cylinders can never require to be double.

Where a very strong light is required in collieries, a large wick may be used, and the cylinder be from 2 to 2.5 inches in diameter. Sir H. Davy has found that a glass cylinder placed

within, above the wick, as in the Liverpool lamp, makes it burn with great brightness, and when the fire-damp is explosive, causes it to give light instead of the wick.

M. F.

A NEW general enumeration of vegetables is announced as nearly ready for the press, under the title of "Editio nova Systematis Vegetabilium Linnæi," by Drs. Rœmer of Zurich, and Schultes of Landishutham in Bavaria. Such a work has become one of the most urgent wants in botany. It is now sixteen years since the first volume of Willdenow's Edition of the Species Plantarum was printed, during which time additions, equal perhaps to all that work contains, have been made to botany, only dispersed on such various points as to be nearly useless for want of the concentration we may now expect. The Editors are both advantageously known by their botanical publications; and we are glad to see that they propose to keep in view the industrious and judicious Willdenow in the progress of their work. The synonymy previous to Linnæus will be generally omitted, a defalcation in a work of this sort perhaps the least detrimental of any. They guess that the whole will be brought within the compass of five bulky octavos, and promise to attend to the purse of their purchasers, but not at the expense of their eyes, as has been done in the Liliputian duodecimos of Persoon.

Royal Institution, January 1, 1817.

The Members and Subscribers are informed that the Lectures will commence on Saturday, the first of February next, at Two in the Afternoon. When Mr. Brande will deliver his Introductory Discourse.—And that the following arrangements have been made for the Season.

On Mineralogical and Analytic Chemistry, and on the Arts connected with these subjects, by W. T. Brande, Esq. Sec. R. S. London, and F. R. S. Edin. Prof. Chem. R. I. &c.

On Practical Mechanics and its Applications to the Arts and to Manufactures. Part the Second, including the principles of Wheel Carriages, Wind and Water Engines and

Mills, Steam Engines and the Force of Gunpowder. By John Millington, Esq. Civil Engineer.

On Botany.—By Sir James Edward Smith, M. D. F. R. S. Pres. Lin. Soc.

On Drawing and Painting.—By W. M. Craig, Esq. delivered gratuitously,

On the Architectural and other Remains of Aboriginal, Roman, Saxon, and Norman Britain, illustrated by Drawings.—By Thomas Stackhouse, Esq.

The Practical LECTURES and DEMONSTRATIONS in CHEMISTRY, delivered in the Laboratory of the Royal Institution, by Mr. BRANDE, will begin on Tuesday, the 4th of February, at Nine in the Morning precisely, and will be continued at the same hour during the Season, on Tuesdays, Thursdays, and Saturdays. The Subjects are treated of in the following order.

Division I. Of the Powers and Properties of Matter, and the General Laws of Chemical Changes.

§ 1. Attraction—Crystallization—Chemical affinity—Laws of Combination and Decomposition.

§ 2. Light and Heat—Their influence as Chemical Agents in art and nature.

§ 3. Electricity—Its Laws and connexion with Chemical phenomena.

Division II. Of Undecompounded Substances and their Mutual Combinations.

§ 1. Substances that support Combustion, Oxygen, Chroline, Iodine.

§ 2. Inflammable and acidifiable Substances—Hydrogen—Nitrogen—Sulphur—Phosphorus—Carbon—Boron.

§ 3. Metals—and their Combinations with the various Substances described in the earlier part of the Course.

Division III. Vegetable Chemistry.

§ 1. Chemical Physiology of Vegetables.

§ 2. Modes of Analysis—Ultimate and proximate Elements.

§ 3. Processes of Fermentation, and their products.

Division IV. Chemistry of the Animal Kingdom.

§ 1. General views connected with this department of the Science.

§ 2. Composition and properties of the Solids and Fluids of Animals—Products of Disease.

§ 3. Animal Functions.

Division V. Geology.

§ 1. Primitive and secondary Rocks—Structure and situation of Veins.

§ 2. Decay of Rocks—Production of Soils—Their analysis and principles of Agricultural improvement.

§ 3. Mineral Waters—Methods of ascertaining their contents by Tests and by Analysis.

§ 4. Volcanic Rocks—Phenomena and Products of Volcanic eruptions.

In the First Division of each Course, the principles and objects of Chemical Science, and the general Laws of Chemical Changes are explained, and the phenomena of Attraction, and of Light, Heat, and Electricity developed, and illustrated by numerous experiments.

In the Second Division, the undecompounded bodies are examined, and the modes of procuring them in a pure form, and of ascertaining their chemical characters exhibited upon an extended scale. The Lectures on the Metals include a succinct account of Mineralogy, and of the methods of analysing and assaying Ores.

This part of the Courses will also contain a full examination of Pharmaceutical Chemistry; the Chemical Processes of the Pharmacopœiæ will be particularly described, and compared with those adopted by the Manufacturer.

The Third and Fourth Divisions relate to Organic Substances. The Chemical Changes induced by Vegetation are here inquired into; the principles of Vegetables, the theory of Fermentation, and the characters of its products are then examined.

The Chemical History of Animals is the next object of inquiry: it is illustrated by an examination of their component parts, in health and in disease; by an inquiry into the Chemistry of the Animal Functions, and into the application of Chemical principles to the treatment of Diseases.

The Courses conclude with an account of the Structure of the Earth, of the changes which it is undergoing, of the objects and uses of Geology, and of the principles of Agricultural Chemistry.

The applications of Chemistry to the Arts and Manufactures, and to economical purposes, are discussed at some length in various parts of the Courses, and the most important of them are experimentally exhibited.

Further particulars may be obtained by applying to Mr. Brande or to Mr. Fincher at the Royal Institution, 21, Albemarle-street.

In February will be published "OUTLINES OF GEOLOGY," being the substance of a Course of Lectures delivered in the Royal Institution, in the Spring of 1816, by W. T. Brande, Sec. R. S. &c. Published by John Murray, Albemarle-street.

NOTICE TO CORRESPONDENTS.

In consequence of an accident having occurred to the Wood-cuts, Mr. B. Gompertz's paper on the Pendulum is unavoidably postponed till the next Number.

Mr. Cooper on Platinum, has *not* come to hand.

The Editor regrets that the description of the Pheasant-breasted Duck is anonymous; therefore not inserted.

Many papers on Blow-pipes have been received, but not sufficiently original for insertion.

The Geological Observations of T. R. P. are not of a tone to be admitted here. *Ridentem dicere verum, quid vetat?* but it should be without *personality*.

The Editor begs to thank his Foreign Correspondents for their valuable communications and advice; he has especially to request that their letters may be forwarded earlier than usual, since their late arrival has prevented the insertion of several interesting Notices in the present Number.

The Proceedings of the Royal Academy of Sciences at Paris are deferred until the next Number.

Some interesting Botanical News from South America, want of room obliges us to reserve.

The Index to the present Volume will be delivered with Number V.

All Papers with Plates intended for insertion in this Journal, should be forwarded either to the Royal Institution, or to Mr. Murray the Publisher, at least one month previous to its publication.

ART. XXVI. METEOROLOGICAL DIARY for the Months of September, October, and November, 1816, kept at EARL SPENCER'S Seat at Althorp, in Northamptonshire. The Thermometer hangs in a north-eastern aspect, about five feet from the ground, and a foot from the wall.

METEOROLOGICAL DIARY

for September, 1816.

		Thermometer.		Barometer.		Wind.	
		Low.	High.	Morn.	Even.	Morn.	Even.
Sunday	1	46	53	29,35	29,42	NW	WNW
Monday	2	39	52	29,53	29,60	NW	WbN
Tuesday	3	35	54,5	29,64	29,59	W	S
Wednesday	4	44	54	29,39	29,27	WSW	WSW
Thursday	5	41	57,5	29,48	29,64	W	NW
Friday	6	39	56,5	29,79	29,79	NE	SE
Saturday	7	51	64	29,74	29,74	WSW	SW
Sunday	8	48	60	29,74	29,69	W	WSW
Monday	9	46	59,5	29,62	29,34	S	SW
Tuesday	10	54	62,5	29,39	29,60	SW	W
Wednesday	11	45	62	29,72	29,74	W	WSW
Thursday	12	40	60	29,83	29,94	W	W
Friday	13	38	60	30,04	30,01	NE	S
Saturday	14	54	68	29.93	29,93	S	S
Sunday	15	50	71	29,90	29,90	SW	SSW
Monday	16	46	66	29,92	29,92	W	N
Tuesday	17	54	65	29,90	29,82	ENE	ENE
Wednesday	18	52	57	29,88	29,91	NE	NE
Thursday	19	52,5	58	30,02	30,00	E	E
Friday	20	31,5	56	30,00	29,84	E	E
Saturday	21	35	55	29,65	29,56	E	E
Sunday	22	51	60,5	29,60	29,66	W	SE
Monday	23	48	58	29,75	29,72	NE	E
Tuesday	24	46,5	59,5	29,72	29,73	NE	SSE
Wednesday	25	43	63	29,95	29,99	SW	E
Thursday	26	35	60	30,05	30,03	E	WSW
Friday	27	45,5	61	30,10	30,08	SE	SW
Saturday	28	47	61,5	29,91	29,90	W	W
Sunday	29	46	58	29,58	29,21	S	WSW
Monday	30	43	57	29,61	29,61	SW	W

METEOROLOGICAL DIARY

for October, 1816.

		Thermometer.		Barometer.		Wind.	
		Low.	High.	Morn.	Even.	Morn.	Even.
Tuesday	1	50	61	29,27	29,50	W	W
Wednesday	2	47	60	29,46	29,41	W	WSW
Thursday	3	41	54	29,83	29,83	WSW	S
Friday	4	51	63	29,74	29,75	W	SSW
Saturday	5	54	62,5	29,77	29,74	S	SE
Sunday	6	53	64	29,75	29,77	W	E
Monday	7	43	53	29,77	29,78	NE	NE
Tuesday	8	52	59	29,80	29,90	SE	E
Wednesday	9	45	58	29,92	29,92	E	E
Thursday	10	54	62	29,95	29,95	E	SSE
Friday	11	50	59	29,90	29,91	W	NW
Saturday	12	44	55	30,	30,01	W	S
Sunday	13	40	54	30,01	29,98	SE	S
Monday	14	39	57,5	29,98	30,	WbS	W
Tuesday	15	40	57,5	30,05	30,05	SE	S
Wednesday	16	38	57	30,	29,82	SE	SE
Thursday	17	37,5	51,5	29,70	29,68	W	W
Friday	18	37	51	29,66	29,79	W	W
Saturday	19	33,5	54	29,79	29,60	W	W
Sunday	20	37	48	29,51	29,51	W	W
Monday	21	39	49	29,58	29,64	W	W
Tuesday	22	38	51	29,56	29,60	W	W
Wednesday	23	32	45	29,80	29,82	W	S
Thursday	24	37	50	29,65	29,53	S	SE
Friday	25	39	49	29,36	29,20	E	SE
Saturday	26	28,5	49	29,46	29,54	SE	E
Sunday	27	37	56,5	29,58	29,58	E	E
Monday	28	45	55	29,52	29,52	ENE	
Tuesday	29	41	53	29,50	29,43	E	SE
Wednesday	30	45	49,5	29,18	29,11	E	SE
Thursday	31	45	51	29,08	29,18	SW	SE

METEOROLOGICAL DIARY

for November, 1816.

		Thermometer.		Barometer.		Wind.	
		Low.	High.	Morn.	Even.	Morn.	Even.
Friday	1	37	47	29,20	29,20	W	W
Saturday	2	29	44,5	29,25	29,17	NE	SE
Sunday	3	39	46	29,22	29,42	W	SSE
Monday	4	29	48	29,60	29,60	NNE	E
Tuesday	5	42	49	29,61	29,53	E	E
Wednesday	6	45	48,5	29,35	29,29	SSW	W
Thursday	7	33	37,5	29,29	29,24	WbN	NW
Friday	8	23	33	29,39	29,39	WbS	S
Saturday	9	32	45,5	28,86	28,67	SW	SW
Sunday	10	30	34	29,26	29,34	NW	SW
Monday	11	16,5	36	29,59	29,44	W	SW
Tuesday	12	34	47	29,10	29,51	SW	W
Wednesday	13	39	53	29,53	29,53	W	W
Thursday	14	35,5	42,5	29,53	29,41	W	WbS
Friday	15	27,5	35	29,35	29,45	WbS	NNW
Saturday	16	24	36,5	29,68	29,87	NW	WNW
Sunday	17	24,5	34	29,94	29,87	W	SW
Monday	18	33,5	44	20,59	29,51	W	WbS
Tuesday	19	26	44	29,60	29,68	SW	SSW
Wednesday	20	39	48,5	29,69	29,80	SW	S
Thursday	21	39,5	42,5	29,85	29,80	SE	SE
Friday	22	36	37	29,70	29,70	E	ENE
Saturday	23	26	31	29,70	29,70	ENE	E
Sunday	24	17	28	29,79	29,79	WSW	W
Monday	25	20	37	29,79	29,78	SSW	SSE
Tuesday	26	37	48	29,80	29,96	NNW	WNW
Wednesday	27	29	47	30,10	30,12	WbS	SW
Thursday	28	33,5	43	30,20	30,20	SW	WSW
Friday	29	30	41,5	30,39	30,41	WbN	W
Saturday	30	31	36,5	30,53	30,55	NNE	N

INDEX.

B

L.

M.

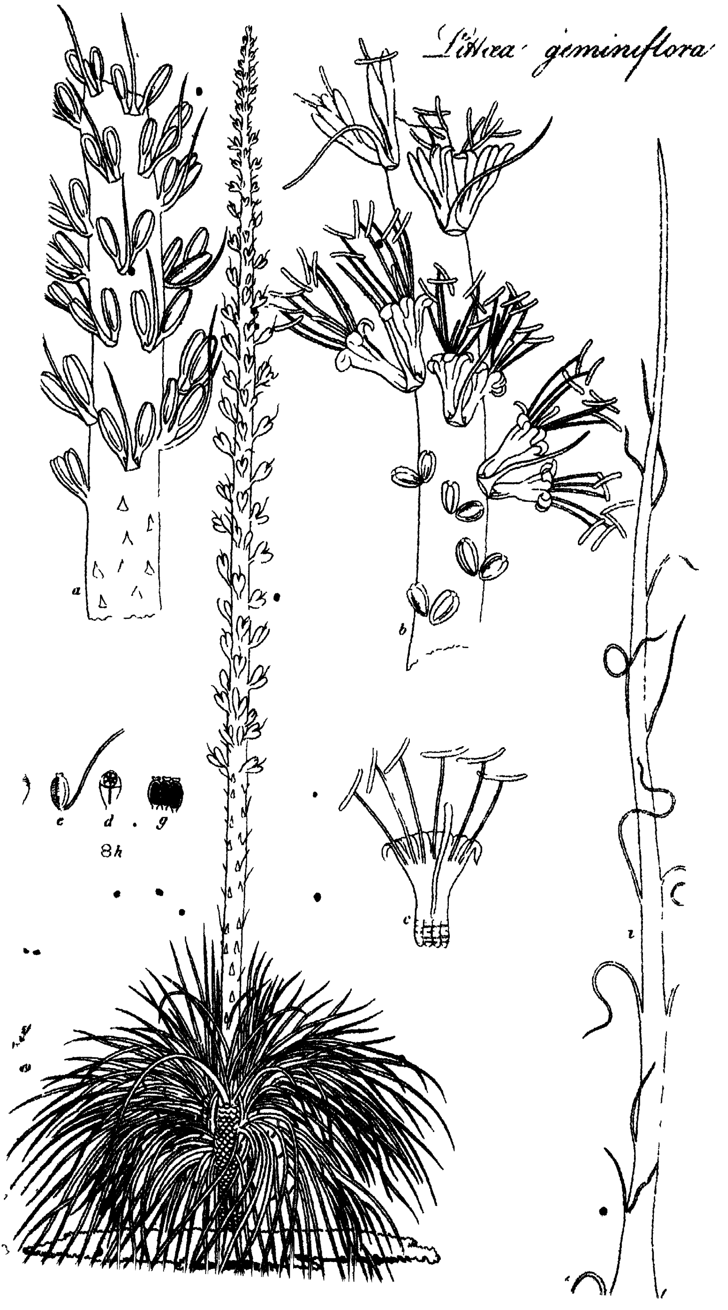
T.

V.

ERRATA.

Page 347, l. 19, *pro* " orchroleuca" *l.* " chloroleuca."
—— 349, l. 3, à calce, *pro* " effusa" *l.* " suffusa."
—— 360, l. 8, a calce, *pro* " obsoletè" *l.* " rotundatè."
—— 366, l. 15, *pro* " ***Bulbispermæ constanter?*** " *l.* " ***Bulbispermæ. Constanter?*** "

London: printed by W. Bulmer and Co.
Cleveland-row, St. James's.


Littæa geminiflora
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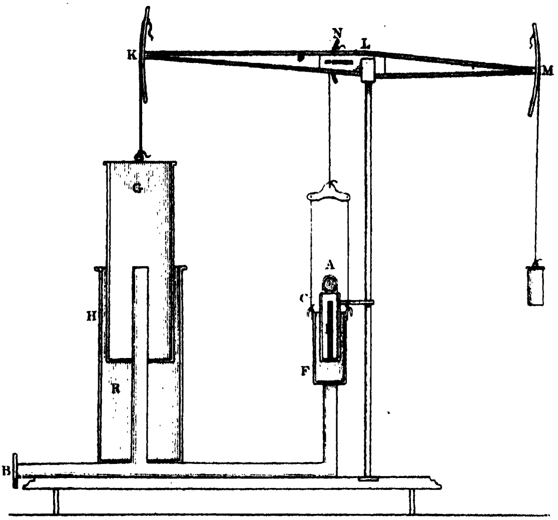
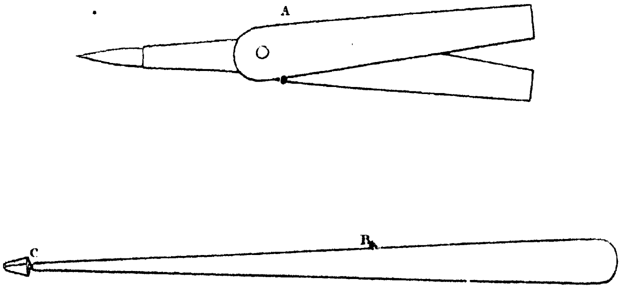
Mr. Clegg's Gas Governor.



Indian Couching Instruments.



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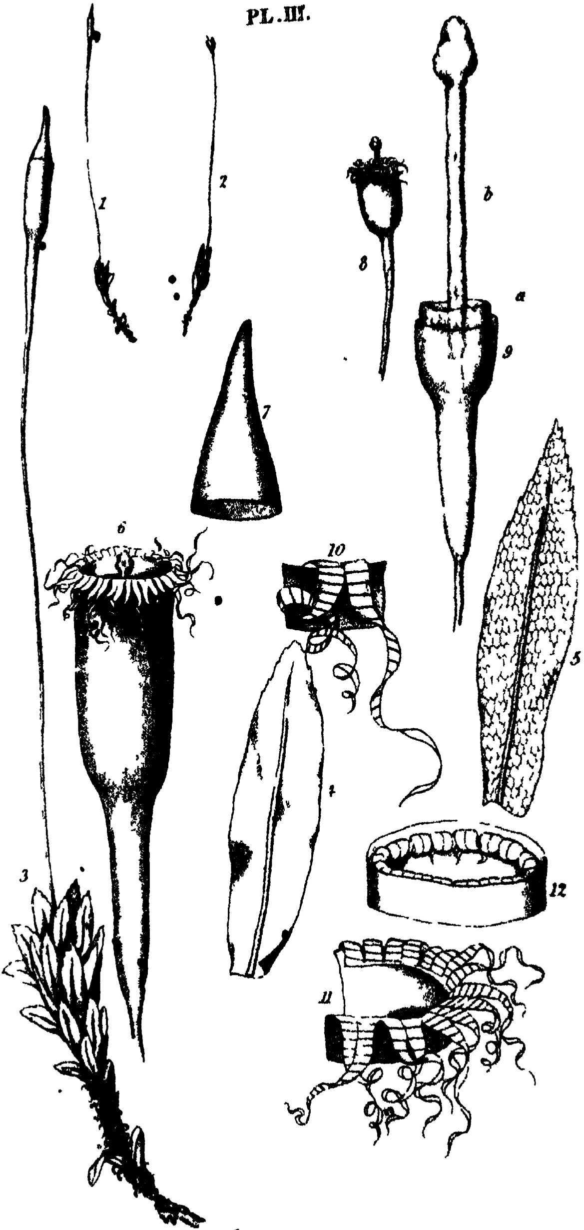
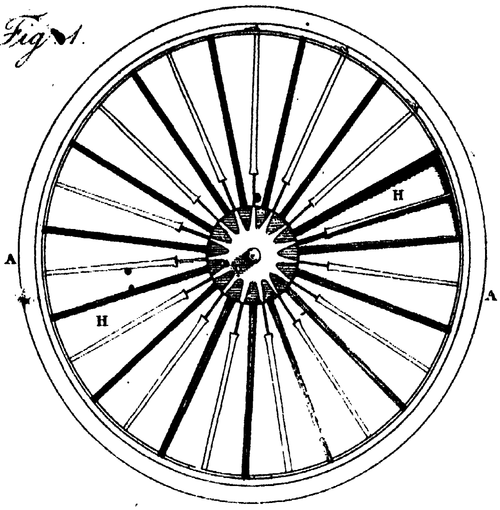


Tayloria splachnoides.

Fig. 1.



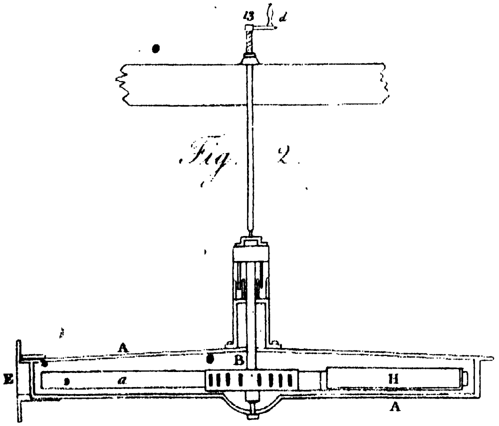


Fig. 2.

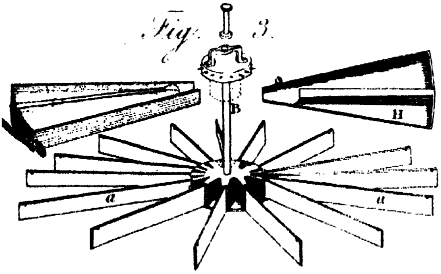


Fig. 3.

Fig 4

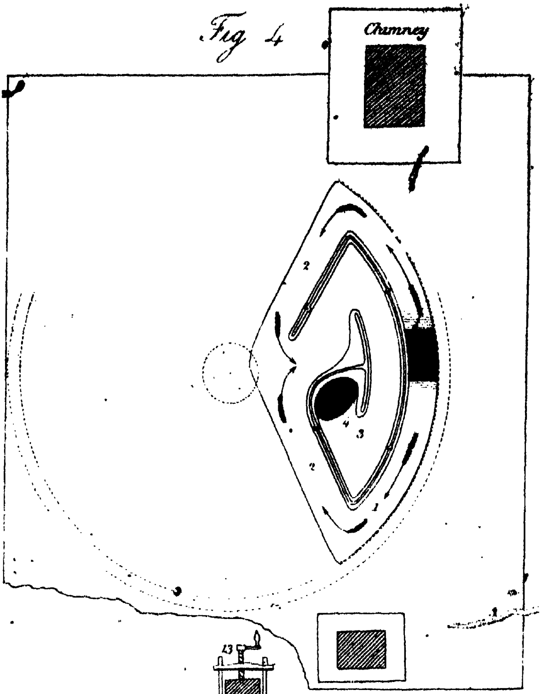
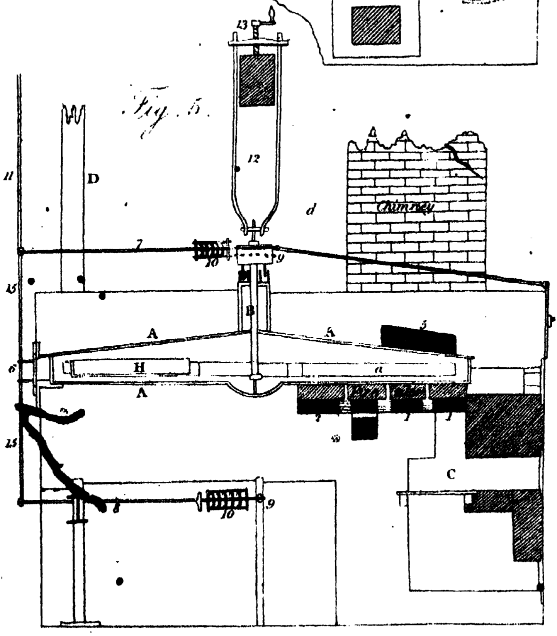
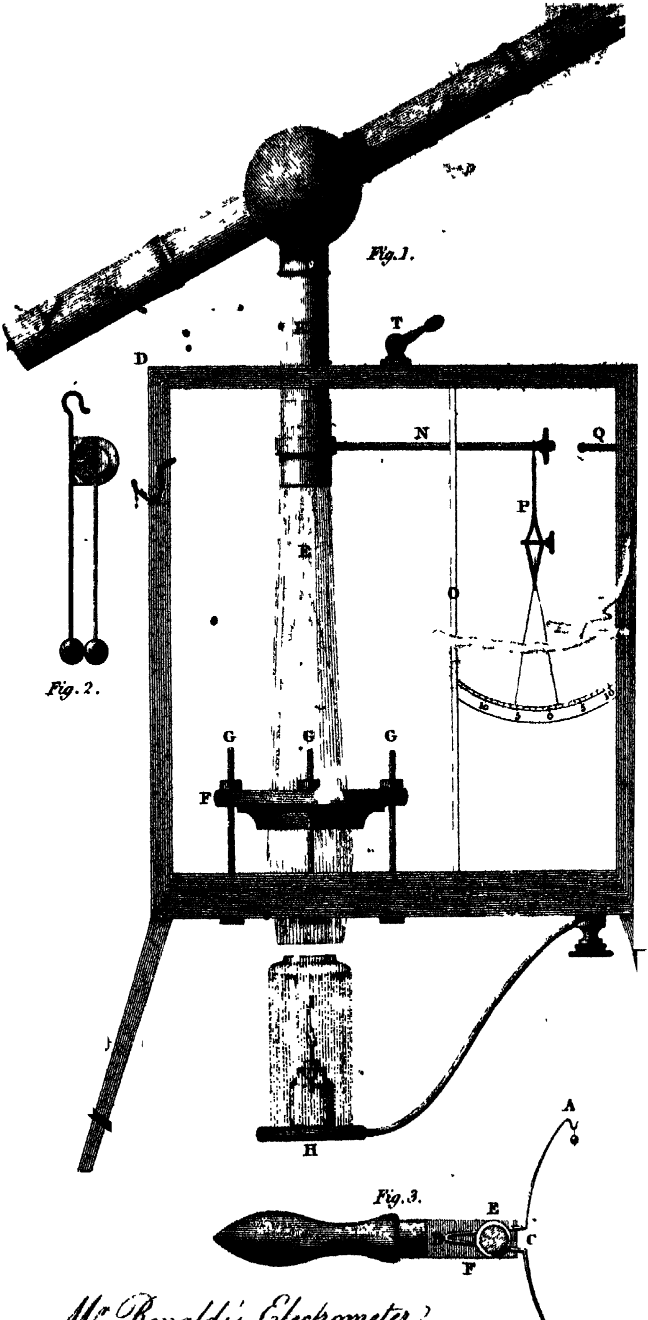


Fig. 5.





Mr. Ronalds's Electrometer.